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ABSTRACT

In the first chapter, the main approaches to educational planning as practiced in the member countries of the Organisation for Economic Cooperation and Development are described: (1) social demand, which subsumes current and supplementary demand; (2) investment in education; and (3) manpower needs. This chapter also reviews the contemporary use of mathematical models in educational planning based on the above approaches. The second and final chapter discusses problems of planning and forecasting methodology and attempts to reconcile the three approaches by combining the sociopolitical criteria coming under the heading of social demand, the economic and financial rationale required in cost-benefit analysis as applied to education, and the technological requirements of industrial society. Related documents are: ED 057 470, EA 004 323, and EA 004 420-424. (Author/JH)

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Background Study No. 8

EDUCATIONAL PLANNING METHODS

The attached report, written by Jean-Pierre Jallade, is one of a series of Background Studies prepared by the Secretariat for the Conference on Policies for Educational Growth. Its subject is closely related to that of two other Background Studies - No. 9, on "The Role of Analysis in Educational Planning", and No. 5, on "Educational Policies, Plans and Forecasts during the Nineteen-sixties and seventies".

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EDUCATIONAL PLANNING METHODS

Summary

The aim in Chapter I of this report is to describe the three main approaches to educational planning as practised in the OECD countries. The usefulness of educational model-building is also discussed.

In connection with the social demand for education a distinction has been made between:

(a) "contingent" social demand, based on projections of trends concerning the supply of places made available by the system (an example is the Robbins Report dealing with higher education in the United Kingdom);

(b) a more "useful" social demand, based on the reduction of certain (usually social) inequalities of educational opportunity, such as: inequalities of access or participation (e.g. access to gymnasia in the Netherlands), inequalities in the development of school careers (e.g. the lower cycle of French secondary education) and inequalities in school achievement (secondary education in the United States);

(c) a virtually "absolute" social demand, based on full utilization of the mental abilities of a particular age group, and on adjustment of the educational system to the capacities of the most underprivileged groups rather than the reverse.

A paradox brought out in discussing the investment in education approach is that, while but a fraction of income is due to education, non-monetary benefits are yielded which are not taken into account. The wage structure used (one based on spatial considerations rather than on forecasts extending over 40 or 50 years of working life) has moreover but a remote connection with the conditions which will be found on the labour market. Two additional requirements must finally be fulfilled: prevailing wages should reflect the productivity of qualified manpower, while levels and types of skill should be fully substitutable. The value of rates of return calculations will depend on whether these assumptions put forward by neo-classical economic theory are accepted or not.

On the contrary qualified manpower forecasts rely heavily on fixed labour-productivity coefficients, once the technological

level has been ascertained; in other words, while no capacity for substitution is assumed to exist as between the occupational categories (or educational levels) concerned, such a capacity is infinite inside them. Another question raised by this method is the link between the notion of needs as based on "technological" or "social" criteria and demand as expressed on the labour market.

As regards mathematical models, it was noted that their use by educational planners enabled any one of the above-mentioned approaches to be expressed in mathematical form. When computerized, the additional flexibility and speed they offer makes them an important factor in the decision-making process, particularly when alternative choices are posed in terms of cost and financing.

Chapter II attempts to reconcile the three above-described approaches by combining the socio-political criteria coming under the heading of social demand, the economic and financial rationale required in cost-benefit analysis as applied to education, and the technological requirements of industrial society.

In the light of (a) recent experience acquired by the OECD countries in developing their educational systems, (b) the variables which are controlled by the governments or planning authorities and those which are not, and, finally, (c) the political means which the latter are ready to use in order to implement their educational policy, such a synthesis presumably should be carried out as follows:

- Largely "autonomous" growth of the educational systems seems to be a foregone conclusion. The only important changes that can be expected as regards the "output" of these systems will stem from current structural reforms, from the more or less rapid resorption of dropouts and from possible qualitative changes. The process of levelling out disparities in educational participation is bound to develop very slowly, at any rate until the "saturation point" (i.e. 100% enrolment) for a particular social group in a given cycle is reached.

  In any case, the trend observed discriminates in favour of the factors which usually govern social demand. In consequence, there is a diminishing interest in planning methods which consider pure economic criteria (rates of return and manpower requirements), at least as they are now formulated.

- This being granted, if it is to absorb steadily increasing numbers of graduates, the labour market will call for radical reforms, all of which must promote greater mobility in view of the lower initial occupational

choice left open to redundant numbers of graduates in relation to needs. This process will have to be accompanied by a feedback effect on the qualitative plane from the labour market onto the educational system.

- It may also be that the democratization of education and its corollary, a fast-increasing supply of graduates, will result in lesser economic benefits being attached to degrees (by reducing wage differentials between levels of skills). This again raises the overall problem of manpower demand and its adjustment to the supply through the medium of wage structures. More broadly speaking, the question to which ultimately a reply must be given is the capacity of the educational system to democratize society.

EDUCATIONAL PLANNING METHODS

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EDUCATIONAL PLANNING METHODS

INTRODUCTION

1. The object of this report is to provide a synthesis of the various methods most commonly used in educational planning with a view to quantifying the criteria which guide, or should guide, the development of educational systems. There are three such methods, which can be defined as follows:

(i) The "social demand" method, which, as its name implies, consists in planning the educational system with a view to satisfying the demand for education as expressed by the family units in a given country. The problem thus consists in quantifying this demand in advance and providing for a corresponding development in the education sector, in the same way as economic planning deduces growth rates for the various sectors of production from the anticipated final demand for the various goods and services.

(ii) The "rate of return" method, on the other hand, is based on criteria of economic profitability. The benefits derived from additional education are compared with the cost of obtaining it, in order to calculate the rate of return on investment in the education sector. This rate is then compared with the corresponding rates in other sectors of the economy; depending on whether the comparison is favourable or not, a decision is taken on whether to invest more in education.

(iii) The "manpower" method, which makes use of manpower forecasts in order to quantify the economic objectives of education, is based on the idea that the educational system is primarily called upon to supply the economic system with the qualified personnel it may require at all levels. The principle of this method is that of "technological complementarity" between the production and the education systems. Educational development should, therefore, be guided by the estimated manpower needs classified by qualification level.

2. The use of mathematical models for educational planning has only recently come to the fore. In their present state of development, the models do not seem to have any originality as a planning method compared with previous methods; but their systematic use is useful if not indispensable (a) in evaluating the ultimate, and sometimes contradictory, consequences of planning forecasts, particularly when the latter attempt to

reconcile the irreconcilable, and (b) to provide rapidly alternative ways of reaching the same series of objectives. In other words, the interest of mathematical models - when programmed - lies essentially in the greater coherence, flexibility and speed which they bring into the overall planning process.

3. There is no need to set out here in detail the possible contradictions of these different approaches. One should, however, state briefly the points at issue:

- The social demand approach regards education as a consumer good which should become available to all as rapidly as possible; the corollary is the reduction of inequalities in the access to education (1).

- In the rate of return approach, education is regarded as an investment, the benefits of which - whether social or private - must be calculated and, if possible, maximised; this leads directly to calculations of the "productivity" of the educational system (2) which, in turn, lead to research into ways of minimising educational costs.

- The special feature of the manpower approach is that it ignores the controversy at the centre of the two previous methods, i.e., whether education is a consumer good or a capital good, and favours strictly technical relationships between the production system and the output of the educational system.

4. As concerns mathematical models, it follows from our previous remarks that they will reflect the one or the other of the approaches, depending on the prevailing fashion. It would be fair to say that these models have been until now mainly econometric, in the sense that most of them accept manpower constraints and the "costs" aspect of analyses of rates of return. They also tend to be increasingly related to models describing the progress of schooling within the educational system. However, these models have not yet touched on any of the "social demand" aspects, such as the different directions followed during their school career by pupils and students from different social groups, different regions, etc.

5. As can be seen, the different methods of educational planning have a theoretical basis which differs considerably depending on the role and function which the planners attribute, implicitly or explicitly, to education in society. This is

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(1) Whether these inequalities are based on social category, region, ethnic group, sex, religion, etc....

(2) Expressed as a ratio of output (pupils leaving the system) to total inputs (teachers, premises ...etc...)

a fundamental question which cannot be evaded. However, the following points can be made:

- Although the planners have been largely responsible for bringing to light certain contradictions, their role is not so much to choose between alternative methods, but rather to present these clearly, with all their implications, to the policy-makers so as to enable them to make the final choice.

- If it is to be of any value, a discussion on the different methods of educational planning must, to a certain extent, take into account all contingencies with regard to place and time, as the object is not to find one final answer to the problem, irrespective of time and/or valid under all latitudes. After all, the role of the educational system has varied considerably from one period to another; and even at the present time, it can be seen in a different light in countries which have almost completed their industrial revolution and those which are just beginning theirs; or in countries with a socialist regime and in others with a different regime, etc.

- Planning methods are one thing, their ability to influence reality quite another. This may be an academic point, but it must be taken into account in the discussion. Some countries have been engaged in educational planning for five or ten years, and their experience with regard to the validity of forecasts should be taken into account in judging the effectiveness of a given method; some methods which give results in some countries will be useless in others, and vice versa.

6. The following report will be divided into two chapters:

(i) The first will present the different planning methods with emphasis on their theoretical aspects. A few examples illustrating each method will help to pinpoint the difficulties in their practical application.

(ii) In the second we shall attempt a synthesis of these approaches, indicating the "specific weight" of each of them in the planning process and their conditions of application. For this purpose, we shall be making liberal use of past experience acquired by OECD countries in educational planning; some approaches, though intellectually satisfying, may prove extremely weak in the face of an inflexible social reality; others, though more unassuming in appearance, may, in some contexts, be more likely to give satisfactory results.

CHAPTER I

EDUCATIONAL PLANNING METHODS - THEORETICAL ASPECTS

7. We shall give here a brief description of the four planning methods listed in the introductory section, i.e.:

- the "social demand" method,
- the "investment in education" method,
- the "manpower" method;
- the contribution of mathematical models to traditional planning.

The aim here is primarily to clarify the principles on which the different methods are based; the difficulties encountered in their practical application will also be discussed.

1. THE "SOCIAL DEMAND" APPROACH

8. The expression "social demand for education" generally means the demand for places in the education system coming from individuals or family units. It can be sub-divided into a current demand - caused by demographic trends and the maintenance of the present rate of progress in enrolment - and an extra demand caused by the arrival of new education 'consumers' from social groups previously underprivileged in this respect. The importance attaching to this supplementary demand enables educational planning exercises based on social demand to be split up into three categories.

(i) Those based on a wholly "contingent" future educational demand, in other words, bound up with present conditions, in particular in terms of motivation in relation to schooling and of "reasonable" estimates of the possibilities of access to and pursuance of studies. In this case, the importance attached to the supplementary education demand over and above what we have called the current demand is likely to be low. The equalisation of educational opportunity is likely to be a very slow process.

(ii) A more clear-cut option in favour of reducing inequality of access to education allows more ambitious targets to be set for the development of the educational system; in this case, present enrolment ratios of social - or regional, ethnic etc. - groups form the objectives for the less favoured groups. This principle is based on the hypothesis that the consumption of education services should be identical throughout the various strata of society, the distribution of ability among these strata not forming any *a priori* obstacle.

(iii) A still more voluntarist attitude consists in basing the development of the educational system explicitly on an exhaustive utilisation of the abilities contained in each age group. To the extent that these can be identified and quantified, they could form the 'absolute' demand for education.

The present context of educational policies in the various O.E.C.D. countries supplies illustrations of these three methods.

A) The "contingent" social demand in educational planning

9. The "contingent" social demand is certainly the most widely used, whether implicitly or explicitly, by all planners. In most cases, evaluating this demand boils down to projecting the current growth rate of enrolment into the future. Since this growth rate is high in most European countries at the moment, many of those responsible think that it raises problems of teacher recruitment, school building, pedagogic renewal, etc. big enough to preclude awakening a potential demand that is all the more frightening as it is unknown.

10. Lastly, in countries which have no educational planning mechanisms (they are becoming rare) and in those where such mechanisms as do exist have practically no effective power(these are very numerous), the development of the educational system has a homothetic character. In the last resort, it is unimportant whether the "contingent" demand for education is officialised or not, for it will always determine what is done.

11. The Robbins Report (1) is a good example of planning based on projecting social demand. In Chapter VI of this Report, the various stages in the calculation of the demand for places in higher education are clearly summarised. They are, in order:

(i) determining the size of the age groups corresponding to higher education;

(ii) estimating the proportion of these age groups leaving secondary education with the necessary qualifications for entry into higher education;

(iii) forecasting the proportion of those entitled who will apply for admission;

(iv) deciding what proportion will, in fact, be admitted;

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(1) Higher Education (Report of the Committee appointed by the Prime Minister under the Chairmanship of Lord Robbins, 1961-63), London H.M.S.O., 1963.

(v) converting the projected number of entrants into the projected number of places by making additional estimates concerning the length of studies and the number of foreign students.

12. The main hypotheses involved in this calculation are as follows. After the demographic projections were made (i), it was estimated that the proportion of the age group qualifying for entry (ii) should increase from 7 to 13% between 1961 and 1980; this, in fact, was an extension of the trend noted between 1954 and 1960. The proportion of those qualified applying for university entrance (iii) will increase by no more than 10% over the whole period, the proportion of young people with 2 'A-levels' going up from 60 to 66%. On the other hand, the ratio of entrants to qualified applicants (iv) will remain constant, which would make for an easier entrance; actually, this ratio had shown a declining trend during recent years. Lastly, the length of studies will tend to increase and the proportion of foreign students in the total to remain constant (v). The social "demand" for education as applied in this case seems, therefore, to have a very restricted character:

(a) there is no specific action whatsoever to increase enrolment ratios in secondary education, and thus the number of those qualified to continue their studies;

(b) the propensity of those qualified to apply for entry in the future is certainly under-estimated;

(c) lastly, the "demand" as such would require that the number of those admitted be equal to the number of qualified applicants, always assuming that these qualifications do, in fact, correspond to the quality requirements stipulated by the institutions of higher education.

13. Does the higher education system really respond to an individual demand for places? Is it not rather the system that determines a "reasonable" supply of places - the supply is it in a position to offer in order to meet the current increase in the number of those qualified by secondary education?

14. It would seem difficult to do less than that, given these two additional conditions, firstly, that schoolchildren retain a more or less unchanged motivation regarding higher education, and, secondly, that one application out of three, even though motivated and qualified, will be rejected.

15. In practice, what we have called the contingent demand is that resulting simply from extrapolating past trends; the various 'brakes' already in the system enabling demand to be

throttled are maintained; and any factors that could intensify motivation towards schooling are unchanged.

B) Social demand based on reducing inequalities of educational opportunities

a) Inequalities of access to, or participation in, education

16. At present, the objective set by many countries is the reduction of social inequalities (sex, ethnic, regional or religious) in educational participation. Given the present enrolment situation in European countries, the objectives relate primarily to secondary education; it is certainly only at this level that these objectives have any likelihood of being attained in any but the remote future.

17. Some educational planning exercises carried out in the Netherlands would appear as an effort to give the social demand for places a somewhat less contingent character and to make it a little less dependent on the potential supply of the system than it is at the moment (1).

18. Firstly, regional differences in enrolment ratios on entry into long secondary education (leading to university) were analysed and an attempt was made to elucidate the causes of these differences. Occupational structure was found to be the variable providing the best explanation of these differences. In other words, regional inequalities in educational participation are merely the reflection of social inequalities, the less urbanised regions having a more unfavourabl structure and vice versa.

19. The second idea is that of a maximum enrolment of an age group set by the intellectual potential contained in that group; thus an admission ratio of 85% for children from the top management social group would constitute the maximum, the other 15% not having sufficient ability for academic secondary studies. Demand can then be easily measured by the number of places required for an 85% enrolment of the children of other social groups. The "voluntarist" nature of this demand is clear, since the purpose is to iron out inequalities due to social origin, whereas rates of admission to the first year of secondary education had increased at roughly the same pace in the various social classes between 1949 and 1960.

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(1) See "The past and future inflow of students into the upper levels of education in the Netherlands" by R. Ruiter, in Social Objectives in Educational Planning, OECD, Paris 1967.

20. For higher education, the demand concept adopted is far more restrictive, since the transfer ratio for certificated secondary education leavers to university is to remain constant and at a relatively low level, particularly for girls (about 20%). In other words, the individual demand for university places will be affected by the rapid growth in secondary enrolment, but the propensity of certificate-holders to continue their studies will be maintained at a constant level, which constitutes a paradox to the extent that the same factors are at work in both cases.

21. Apart from this work done in the Netherlands, several similar studies have been made in OECD countries (1). Their respective methodologies, largely conditioned by the availability of statistical data, are very similar.

22. The starting point consists in noting regional inequalitie in educational participation. These are usually typified by an enrolment ratio calculated for a given age (access) or a given age group (participation) in each region. The number, and consequently the size, of the regions vary from 8 in Yugoslavia to 800 in Norway; their degree of uniformity varies in consequence. The second stage consists in finding "explanatory" factors for these disparities. They are practically always the same:

(i) distance from school to home, a function of the country's degree of urbanisation;

(ii) material resources of families and cost of schooling;

(iii) employment possibilities for young people with low-level qualifications;

(iv) parents' social status category and/or level of education;

(v) wife's attitude to marriage and occupational life;

(vi) child's past achievement in school.

23. The respective influences of these various factors may vary, of course, from country to country and according to the educational levels considered. In the case of France, for example, at the level of the first cycle of secondary education (2), the distance between home and school was held

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(1) For a general survey of the question, see Group Disparities in Educational Participation, Paper No. 4 /STP(70)9/ of the Educational Growth Review.

(2) Four-year guidance cycle, sixth to ninth years of study.

to be the primary factor in the participation of some categories of children in certain "vertical" aspects of this educational level; the predominance of sons of country people in the old school-leavers' classes (post-primary) is now disappearing; at the other end of the scale, there is a majority of sons from the managerial and the middle class in sections leading to university. Hence the school map - based on demographic projections - which is used for the siting of new and comprehensive establishments i.e., those containing the various vertical sections of the first cycle, over the whole of a system's area. The fact of bringing all secondary education channels within range for the whole of the population does represent an effort to remove geographical obstacles, but there are, of course, other obstacles.

24. As we have seen in the Netherlands it is considered that a region's occupational structure is the factor exercising the greatest influence on "gymnasium" participation rates. At the higher education level, however, distance constitutes an obstacle in the case of technological institutes, though not in the case of universities. Women's attitude towards higher studies is undoubtedly a determining factor for enrolment ratios at this level.

25. The third stage generally consists in representing these "explanatory" factors by a simple arithmetical number. For some of them, this presents no difficulty, but for others a certain veiling of reality is inevitable, as in the case of the "occupational structure index" used in the Netherlands study (1).

26. Then the enrolment ratios are related to their "explanatory" factors by means of single or multiple correlation coefficients. In fact, only single coefficients of correlation are really usable in view of the high degree of collinearity between the explanatory variables themselves. Thus parents' educational level in a region, the region's occupational structure and its degree of urbanisation are all separately, and in decreasing order of importance, factors linked to enrolment ratios. All these factors are also closely interrelated, so that it is not possible statistically to separate their respective effect on enrolment ratios.

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(1) This index is worked out in the following way. The numbers employed in the various occupations in a given region are multiplied by the grammar school admission rates for the children of these groups, calculated for the country as a whole; the product obtained is divided by the total number in all groups. This weighted average of the regional manpower composition has been called "social class index". One cannot help querying the significance of this index: why weight by participation ratio? Wage structure, educational level or anything else could have been used just as well.

27. Generally, therefore, it is the most rigid single relationship that determines the factor which can be used for forecasting, and even then the development of this adopted factor has to be forecast and, if necessary, accelerated. Sometimes this is likely to be neither simple nor easy. It is certainly possible to change girls' attitudes to studies by the right sort of publicity; but it would be more difficult to affect the educational level of parents, one of the factors determining enrolment ratios, since this educational level can be raised significantly only by that of the following generation (1); the present and future development of the educational system, in this case, would be a function of its past development. As regards occupational structure, this will change largely as a function of economic variables, e.g. per capita income, degree of industrialisation, type of activity, etc., all of which are linked to enrolment ratios.

28. Here, therefore, the problem of cause and effect is primordial. The only way for progress to be made in this area is to remove the obstacles to enrolment one by one. It is pointless to disguise the fact that some of them are deeply rooted in society; a policy designed to iron out inequalities, if unaccompanied by social reform, would seem illusory.

(b) Inequalities in school career

29. Once access to and/or participation in a school cycle are secured for practically the whole of an age group, there remains the problem of ensuring that inequalities do not reappear during the course of schooling.

30. Two methods have been used for studying these inequalities. The first is in all respects identical with that described in the preceding section, the only difference being that participation rates are replaced by success rates per region at a given educational level: for example, in Norway, the proportion of those leaving primary school who finish secondary school five years later, or, in Great Britain, the percentage of 13-year-old schoolchildren still at school four years later. The "explanatory" factors for these rates are roughly the same as for the participation rates, and the interpretation problems wholly similar.

31. Usually the starting point chosen is regional disparities, because statistical enrolment data are available in this area, national enrolment ratios merely being the

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(1) Interregional migration of qualified personnel may also contribute significantly to this, particularly, country-town migration.

aggregates of the regional figures. A more ambitious method is to follow a national sample of schoolchildren after first establishing a number of their personal characteristics, such as place of birth, parents' occupation and education level, etc. These characteristics can then be related to children's school streaming, their school progress (repeatings and drop-outs).

32. A study of this kind has been carried out in France (1). A cohort of 18,000 schoolchildren was studied from the time it left primary school until its admission into the second cycle of secondary education, i.e., five years' schooling.

33. Here we have a study of time-related flows whose results are expressed in terms of conditional probabilities, such as the percentage of pupils completing a given schooling cycle within a given time by father's social category, etc. The primary interest of this type of study is that it brings out the different streamings of children in a cycle that is theoretically part of compulsory schooling. These streamings constitute just as many inequalities which are generally masked by global participation rates. Their causes are then investigated by the sub-sampling technique; in this, the sub-samples are related to sex, home, father's occupation, age, and previous achievement at school. The comparison of the enrolment tables for each of these sub-groups clearly shows that sex, for example, has no influence on streaming and the schooling lag associated with it; however, the nine social status categories used condition school streaming to a considerable extent. These conclusions are of the same kind as those arrived at by comparing participation rates with their "explanatory" factors, using single correlation coefficients. It is also possible to show the combined impact on streaming of two factors, in this case, age and previous achievement at school (2), or the impact of one of them with the other kept constant (see the school-life tables in relation to achievement at school for each age). This information is similar to that obtainable from multiple or partial correlation coefficients. The point where things become complicated is when the order of importance of the different factors - social origin, age and achievement at school - has to be established. In our case, this problem is avoided by the fact that the influence of the father's occupation makes itself felt on the direction taken by the

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(1) "Orientation et selection scolaires; cinq années d'une promotion", by A. Girard and H. Bastide, Population, January-February and March-April, 1969.

(2) The authors are the more justified in so doing as one of their variables, achievement at school, has a direct consequence on age, since the factor concerned is the repeating in the last class of the primary cycle.

child at the beginning of the cycle of studies being considered (1) and can be disregarded thereafter. But if the structure of this cycle had been "comprehensive", the problem would inevitably have arisen, and the comparison of series of enrolment tables showing in turn the impact of each factor with the others kept constant would probably have failed to solve it.

34. The method of following cohorts in time thus enables a real situation to be seen dynamically, and avoids the artificial device of regional breakdown. But it comes up against the same conceptual problems as the latter.

(c) Inequalities in respect of achievement at school

35. As might be expected, the countries where total enrolment of the secondary level age group is in process of realisation tend to be more concerned with problems of disparity in achievement at school. It would seem that, once quantitative equality in participation was achieved at a given schooling level (2), more subtle inequalities became apparent with regard to the branch of education involved (academic, technical or occupational in countries where these streams exist), to the quality of the school attended when the educational cycle is of the "comprehensive" type, and, lastly, to the achievement of pupils at the end of the cycle.

(i) The first source of inequality, the type of education followed, is beginning to be seriously combatted in a number of European countries. By and large, all current structural reforms of the secondary cycle can be said to represent an attempt to move from an initial situation of pupil differentiation by vertical sections of differing prestige and duration to an "integrated" educational cycle. Admittedly, the degree of integration may vary (3) from the retention of some barriers to mobility - such as programmes, pedagogic methods or a different "spirit" in different sections - to a quasi-total integration on the American or Japanese models.

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(1) To such an extent that it results in hyperselection for the least favoured groups; the rate of progress of the minority of children from these groups selected for long cycle education is even better than that of children from more favoured groups.

(2) In OECD countries, this means integral enrolment of the age group, the only method known at present of remedying under-enrolment of ill-favoured social groups.

(3) See Development of Secondary Education, Trends and Implications , OECD, Paris, 1969.

Be this as it may, all these reforms come under the heading of "democratisation" or the equalisation of opportunity provided by education.

(ii) The second cause of inequality, that related to the quality of the school attended, is likely to be found in all countries where total enrolment is on the point of being achieved and where the educational institutions depend on highly decentralised administrative authorities. The United States is a typical case. In that country, democratisation in the European sense of the word can be said to have been practically attained at the level of the last year of the high school (1). The social origin of children in a given school tends to reflect increasingly the social status structure of the community served by the school. The only problem is that the social profile of these communities varies enormously, and the social composition of the schools will vary in consequence. In rural or industrial areas with a predominantly manual worker population, the schools will have a majority of "working class" pupils (2). It is clear that the composition of these schools will have the familiar repercussions on methods of teaching, teachers' qualifications, etc. in the absence of a corrective policy.

Clearly European countries will, sooner or later, have to face up to the same problem.

(iii) The third inequality emerges when it becomes apparent that, within a representative sample of all the schools at a given level, certain social groups are systematically at a disadvantage in relation to others as regards achievement at school. It is essential to relate this achievement, measured by ad hoc performance tests, to all the factors capable of influencing it, in order to uncover those which affect it most. One of the most ambitious studies in this area is known as the

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(1) Twelfth year of studies.

(2) It has been shown that the social composition of the schoolchildren is reflected by school size: those with the greatest numbers are over-populated with children from the managerial class and under-populated with children from the manual workers class. The reverse is true in schools with small numbers. See, "The clientele of comprehensive secondary schools in the United States" by N.R. Ramsey, in Social Objectives in Educational Planning, op.cit.

Coleman Report (1). Its purpose is to pinpoint schooling inequalities in relation to the eight ethnic groups making up the United States school population. One of its chapters is devoted to a study of the factors affecting achievement at school.

36. The most interesting conclusions of this work can be summed up as follows.

- The social origin and aspirations of schoolchildren condition their achievement to a very large extent; and this is truer still for ethnic minority children than for those of the white majority. In other words, the latter are more likely to overcome their initial deficiencies than the others.

- This relationship between social origin and achievement does not diminish during the course of the school career, in other words, schooling does not have the corrective effect on inequalities (due to birth, family and milieu) that one is entitled to expect.

- Independently of the pupils' social origin, the student body characteristics - measured by parents' educational level - is the factor most closely related to achievement at school, more closely, in any case, than the quality of the teaching body or of equipment or curricula at the school (2).

37. Clearly, the primary aim of this type of study is not the quantification of objectives to be reached. But the search for the causes of an inequality - in the present case, in respect of achievement at school - is a necessary step for policy guidance; faced with a phenomenon whose causes appear to be multiple and intertwined, it is essential to know where to direct the effort, in other words, on which variable to act (3).

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(1) Equality of Educational Opportunity, by J.S. Coleman and Associates, U.S. Office of Education, Washington, D.C. 1966. See also International Study of Achievement in Mathematics, Torsten Husén (ed.), International Project for the Evaluation of Educational Achievement (IEA), Wiley, London, 1967. This study presents a very schematic comparison of secondary schoolchildren's achievement at school in mathematics in a dozen countries, and an investigation into the causes of the differences observed.

(2) These conclusions are remarkably similar to those found at the end of International Study of Achievement in Mathematics, op.cit.; see chapter 7 of volume II.

(3) For a critical evaluation of the Coleman report and similar studies, see Problems in the econometric analysis of educational technology, by F.L. Colladay, Report No. 11 of the Educational Growth Review.

C) Social demand based on maximum utilisation of abilities.

38. The types of social demand discussed so far have, in every case, been "restrictive" to a greater or lesser extent. Whether the demand be reduced to extrapolations of past trends, or based on a reduction of quantitative and qualitative inequalities, it does not involve any 'maximisation of objectives'. In the United States, for example, raising achievement at school of black children to the level of the white children does not mean that the present achievement of the latter represents the optimum utilisation of their abilities.

39. In other words, the "absolute" social demand for education may find expression if the following three conditions are met.

(i) The supply of places by the educational system is practically unlimited, or at least does not form a bottleneck. If this primary condition is not met, there is every likelihood that the 'demand' will be confined to the system's capacity to absorb it (see section A).

(ii) Favourable attitudes towards education are developed to the utmost by both parents and children so as to overcome handicaps due to social origins, family background and environment. The school itself is sufficiently capable of correcting these initial handicaps and bring its pupils, at the end of their schooling, to the same "starting line" (see section B).

(iii) Lastly, the reserves of ability for each age group are identified and utilised to the utmost. Efforts are being made in some countries to quantify these reserves. The social demand for education will then have an even less restrictive significance; it will mean, in fact, education for all, less that fraction of the age group formed by the "unfit". In practice, it presupposes the realisation of conditions (i) and (ii).

40. That every individual should be given the opportunity to develop his abilities to the full is considered a practically universal right. The whole problem, of course, lies in drawing the line between those who are able to do so and those who are not. A first method consists in distributing the whole of a given population according to its abilities as measured by tests (intelligence quotient, army recruitment tests, etc.). Then a minimum ability for a given educational level is determined by means of a similar distribution of a sample at school at this level. The reserves of ability are equal to the difference between the numbers actually at

school and those that could be at school by virtue of having a higher ability than the minimum.

41. A variant of this method consists in adopting the hypothesis that the abilities of the social group with the highest enrolment ratio are being fully utilised (no reserves available). If the distribution by ability of the other social groups is known, the sum of reserves that could be exploited can be obtained by taking the difference between actual enrolment and the upper limit represented by the group with the highest enrolment ratio at that time. Studies made in this connection by the Netherlands Central Planning Bureau and the Swedish Commission for Higher Education are based on this hypothesis (1).

42. The criticism of these methods most frequently voiced is that they assume that "ability reserves" is a static notion placing far too high a value on an individual's innate potentialities, i.e., those that cannot be altered. Without denying the existence of genetic limits conditioning usable ability reserves in a given population, it seems clear that "intelligence, like the other human capacities, should be considered less as an individual property and more as a social or cultural product;" in other words, "a process of economic and social development is a process of ability creation"(2). Thus ability reserves vary with time, and it is difficult to see where to draw the line that would define social demand.

43. The second criticism obviously concerns the way in which ability is measured. Normally this is done by tests which apply only in relation to pedagogic methods, programmes and the "spirit" of a given educational system, all reflecting the dominant values of the society in question. If, for example, 20% of the children in an age group are classified "unfit" according to traditional secondary education standards in a European country, should the aim be to retain this education as it is, or should programmes and methods be introduced which will enable the "unfit" to participate in it?

44. To sum up, social demand based on utilisation of ability may also be "restrictive" to the extent that the latter is measured by non-neutral tests which favour certain aptitudes at the expense of others. The social demand approach, in the absolute sense of the term, leads, therefore, to the adoption of an objective that is as clear as it is remote; it is the enrolment of everyone, admittedly in relation to each person's individual ability, but doing everything possible to arouse this ability when it does not

(1) See "Reserves of Ability: Size and Distribution", by P. de Wolff and K. Härnqvist in Ability and Educational Opportunity, OECD, Paris 1961.

(2) For a more detailed discussion of these questions, see Ability and Educational Opportunity, op.cit., in particular Chapter I, by A.H. Halsey.

exist, and to exploit abilities which are not recognised as having the greatest prestige in the existing educational system. The development of schooling for handicapped children, the introduction of technical or manual disciplines in programmes largely dominated by verbal or abstracting abilities are all attempts at meeting these requirements in many European countries.

2. THE "INVESTMENT IN EDUCATION" APPROACH

45. The philosophy of this approach and that of the preceding one are at opposite poles. Though there may be some minor differences among them, the advocates of social demand set their sights on an ever-increasing spread in the consumption of the education service throughout all social strata. The situation of students after school age, their chances of employment and the benefits they may possibly enjoy from their education are never taken into account; the latter, in particular, are held to be so essential and obvious as not to require any quantification.

46. The advocates of investment in education, on the other hand, regard education as a capital good representing an outlay during its consumption, but bringing profit, or benefits, at a later date. By relating the latter to the former, they work out a rate of return on education which, compared with the returns from other economic activities, should enable rational choices to be made regarding educational development. The problem of who is to benefit from the expansion of the educational system is, of course, not dealt with, nor is that of qualified personnel needed by the economy.

A) Rates of return on education

47. Like any other rate of return, the rate of return on education is based on two calculations (a) benefits and (b) costs.

48. To calculate the benefits, a three-input table is used interrelating educational level, age and earnings. These statistics will enable the supplementary earnings related to each educational level to be calculated in relation to the preceding level over the whole length of active life. Since these supplementary earnings are not solely due to the extra education received, only a part of them, generally two-thirds, is included in the calculation of the rate of return.

49. For costs one can use either:

- the total resources devoted to a given educational level in a given economy; in this case, the resources should be compared with earnings before tax, and the result is called the "social" rate of return;

- or students' personal expenditure on their education plus the income they would have earned had they been at work; these costs are then compared with income after tax, and the result is the "private" rate of return.

50. The internal rate of return is the discount rate obtained by equating the present value of that fraction of the supplementary earnings which corresponds to extra education throughout the length of active life with the cost of this extra education.

51. According to the advocates of this approach, these rates, worked out for each level and type of education, are essential for determining priorities in terms of resource distribution as between education and other economic sectors, or as between the different branches of the education sector. Even so, they only indicate the direction in which resource allocation should be changed, e.g., greater investment in technical education, without specifying how much or for how long.

52. The application of cost-benefit analysis to education has given rise to a large number of publications setting out in great theoretical and practical detail the advantages and limitations of this type of calculation (1). Two kinds of objection have been made to it. The first is mainly expressed by the "social demand" school, who dispute the soundness of introducing economic rationality into educational problems; they hold that sociological roots and their political consequences are such that cost - and *a fortiori* profit - considerations must be regarded as altogether secondary if not superfluous.

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(1) The basic work on this subject is Human capital, a theoretical and empirical analysis with special reference to education, by G.S. Becker, NBER, 1964. This book was preceded and accompanied by a whole series of articles, most of them of American origin, designed to throw light on the links between income and education. See also "Annual and lifetime income in relation to education 1939 - 1959", by H.C. Miller, American Economic Review, December, 1960; "Education and Income", by H.S. Houthakker, Review of Economics and Statistics, February, 1959; "On the job training: costs, returns and some implications", by J.S. Mincer, Journal of Political Economy, October, 1962.

Outside the United States, the best work on this subject is the paper by Mark Blaug, "The rate of return on investment in Education in Great Britain", Manchester School of Economics and Social Studies, September, 1965. Lastly, the special number of the Journal of Human Resources (Summer 1967), entitled "Symposium on rates of return to investment in education", gives a general survey of the main results obtained so far.

In French, see "La mesure des effets économiques de l'education", by André Page, Revue Economique, March, 1964.

53. The second kind of objection comes from the economists themselves who, whilst recognising the general applicability of cost-benefit analysis and its value as an indispensable tool in rationalising decisions in any activity, consider that such analysis can have only a very marginal interest, if any, in the case of education.

B) Education and income

54. The basis for the rate of return approach is the relationship between income and educational level. The problem has two facets: firstly, the fraction of income due exclusively to the educational level has to be determined (for there are other factors involved in determining income); secondly, an educational level secures non-monetary benefits to both the individual and society.

55. Taking total income into account would lead to an overestimate of the rate of return in the first case, and an underestimate in the second. It is no exaggeration to say that the significance of the rate of return will depend on the solution of this paradox. Unfortunately, the few empirical research projects on this subject have so far produced very meagre results.

(i) Thus, despite its importance, the rank to be given to the degree of education as one of the factors determining income has not yet been the subject of systematic research. Several studies, mostly American in origin, touch marginally on this question, but none is really satisfactory (1). It is sometimes

(1) In his book, Becker is mainly concerned with the distortion caused by one of these factors, i.e., "ability", always highly correlated with education (op.cit. p. 79 et seq.). Miller's and Houthakker's studies, referred to in the previous footnote, are also not expressly calculated to solve this problem; both are confined to the traditional tripod: income, education and age. Conversely, this was precisely the aim of J.H. Morgan and M.H. David in their "Education and Income", Quarterly Journal of Economics, August, 1963, but these authors, by failing to give the interrelations between the explanatory variables for income - the critical issue - seriously restrict the scope of their study; moreover, in this case, the "ability" factor is not included in the analysis.

difficult to synthesize their results in any coherent manner. Those by Wolfle and Smith (1) suggest that 70% of the difference in income between the "some years at college" group and that formed by "high-school" graduates is held to be due to the extra education received, the remaining 30% being considered as primarily due to two factors: parents' occupation and aptitudes.

According to Morgan, David, Cohen and Brazer (2) only 35% of the variation in hourly earnings of a heads of family sample is "explained" by an impressive list of fourteen factors; the influence of occupation is almost as great as that of sex, the latter coming just behind the grouped education-age variables. The ability factor itself has a negligible impact, but it is assessed according to the "judgement of the interviewer on the informant's ability to answer the questions".

These two results are practically everything we have on the factors determining income and the influence to be attributed exclusively to education (3). Based on extraordinarily limited samples (3,000 persons),

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(1) "The Occupational Value of Education for Superior High-School Graduates", Journal of Higher Education, April, 1956. These results were obtained on the basis of a sample of 2,759 persons graduating between 1933 and 1938.

(2) Income and Welfare in the United States, by Morgan, David, Cohen and Brazer, McGraw-Hill, 1962.

(3) This scarcity has certainly helped to enhance the reputation of these results and to their being constantly quoted in the literature on this subject: see Blaug "The rate of return ..." op.cit. p. 214; Becker "Human capital ..." op.cit. p.79 et seq. Wolfle and Smith's results also seem to be the only justification Denison could find for his famous coefficient, .4: the differences between wages are reduced by 40% to allow for the correlation between education and ability as well as other variables linked with wages. See The residual factor and economic growth, OECD, Paris, 1964.

their application even to the United States as a whole is risky; how much more risky their application to other countries, particularly the developing ones, where educational level, social origin and income are likely to be interrelated in a totally different fashion (1).

There is no reason a priori why the "two-thirds rule" should apply to all countries, to all educational levels within a country and, above all, to all ages. Using rate of return calculations in education, therefore, imposes a thorough preliminary study of the factors determining income. There is probably no need to point out that the problem is not fundamentally different from that raised by the social demand approach, where the issue was the determination of the relative influence of various factors on achievement at school. Only the dependent variable is different; in this case, it is income instead of achievement at school or enrolment rate. Sociologists and economists are here facing the well-known problem of attributing to each explanatory factor its exact share in the explanation of the variance of a dependent variable. In fact, they cannot avoid having to add together the variances due to each factor, which is correct only if they are wholly independent (2). One consequence is to assess to the first variable introduced into the equation more explanatory power than it actually has by including all the interactions with other variables, instead of splitting them between the variables in an appropriate way. To overcome this problem, one can use the empirical method which consists in varying the order in which the variables are introduced into the equation. This may not give a single estimate of the explanatory power of each factor, but it does at least give a range for and the approximate magnitude of the respective influence of each factor in determining income (3).

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(1) An a priori hypothesis in the case of non-industrialised countries could be that educational participation, particularly at higher levels, is the prerogative of the highest social classes, so that it could prove very difficult to separate the influence of social origin and level of education on the income level. It is possible, on the other hand, that the ability variable is weakly correlated to educational level, and therefore income, in view of the low enrolment ratios in these countries.

(2) See "The rate of return to education: a critique", by S. Merrett, Oxford Economic Papers, November, 1966.

(3) This technical point constitutes one of the main critiques made to the Coleman Report. See "The determinants of scholastic achievement, an appraisal of some recent evidence' by S. Bowles and H.M. Levin, Journal of Human Resources, Winter 1968; and J.S. Coleman's reply, "Equality of educational opportunity: Reply to Bowles and Levin", Journal of Human Resources, Spring 1968.

(ii) The second aspect of the problem is that education secures non-monetary benefits for both the individual and society. Rate of return calculations have always knowingly disregarded these benefits (1). Thus, unless the latter are regarded as being very small or non-existent, the rates calculated are always lower than the real rates which would allow for non-economic benefits, psychological in the case of the individual, and socio-political for society. Needless to say, these real rates cannot be calculated. This is not without serious consequences, since rates of return on education are to be compared with those on other types of public expenditure. If the benefits included in the calculation of the latter are better defined - which is likely to be the case for purely material investments, such as the generation of electricity, for example - the discussion may become confined to the degree of underestimation of the rate of return on education particularly if this is somewhat lower than the others.

56. Here, our conclusion must be that, prior to any calculation of the rate of return, there is an urgent need to investigate the probably complex relationships between income and its determinants. The difficulties will be of the same order as those encountered in the social demand approach for the determination of the factors affecting participation and school career and achievement.

57. However, if there are factors other than the traditional ones (such as education and age) influencing income level, it is clear that they would seriously limit the significance of the concept of average wage level for persons of a given educational level in a given age group. This average, on which the entire rate of return approach is based, would then suffer from a dispersion, perhaps of considerable proportions, in wage levels according to social origin, ability, sector of activity, etc. (2). A study of this dispersion would seem essential in order to confirm or deny the importance of these factors in relation to those of age and educational level taken jointly. One cannot, therefore, fail to be surprised that none of the advocates of rate of return calculations should yet have concerned himself with this question.

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(1) Simply because they are impossible to quantify. The problem is the same for indirect benefits, such as greater mobility of active population, more favourable environment for research, etc. For a detailed list and an unconvincing discussion, see M. Blaug "The rate of return ..." op.cit.

(2) The simple fact that two university-qualified engineers of the same age should make their careers, one in the oil prospect industry, and the other in public administration, would seem sufficient to generate a considerable difference in their earnings and, therefore, in the rates of return on their education.

C) Rate of return and labour market

58. We have seen that rates of return on investment in education are taken as signposts calling for greater or less investment in a given sector, their variations reflecting joint variations in benefits and costs. Here we shall discuss more particularly the former, making the following assumption: when the differences in income of active graduates increase (or diminish), young students feel encouraged (or discouraged) to follow a given type of studies. But we need to be sure that these changes in income differences really reflect the shortages or surpluses of these graduates in the labour market; in other words, the market should be perfectly competitive and exclude any form of rigidity.

59. There is clearly no way of forming a categorical judgement on the degree of fluidity of a given labour market; in each country, situations obeying the laws of the market coexist with others that do not. But it may be worth recalling, in this context, that at the beginning of the sixties, 42% of people in Japan having received a university education were employed in the services sector. The corresponding proportion was 58% for the U.S.A., 62% for Belgium, nearly 70% for Norway and Sweden, and not far short of 75% for the Netherlands (1). Admittedly, some laws of the market are not necessarily absent from this sector, but the least that can be said is that wage levels on engagement, or subsequently, are only very loosely related to the supply of graduates to the labour market (2).

60. Does this mean, therefore, that the rate of return approach is unusable whenever we have an imperfectly competitive labour market? Certainly not; these cost-benefit analyses can be fruitful up to a point, even in countries where variations in graduates' income are not the result of supply of and demand for these graduates on the labour market.

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(1) Census data taken from Statistics of the Occupational and Educational Structure of the Labour Force in 53 countries, OECD, Paris, 1969.

(2) Needless to say, the situation in developing countries is even worse in this respect; occupational mobility is very low, institutional inflexibility as regards recruitment very great, circulation of information non-existent, etc. On this point, see "Shortages and surpluses in education in underdeveloped countries: a theoretical foray", by H. Liebenstein, Education and Economic Development, edited by Anderson and Bowman, Frank Cass and Co. Ltd., 1966.

61. This comes out clearly in one of the few books that use rates of return exclusively as a tool for employment market analysis in a developing country (1). The most convincing parts of this work are those demonstrating that the continuous increase in the supply of qualified manpower by the educational system can be explained by favourable private rates of return. The attitude of students or their families in asking for more and more education is held to be perfectly "reasonable" in view of the difference in earnings between the various educational levels and the very low costs of education. Whatever the real value of the rates of return put forward, they have the unquestionable virtue of stressing one of the reasons for the surplus in the supply of qualified personnel, i.e., the existing wage structure by level of qualification. Is this why we are somewhat disappointed by the remedies the authors suggest? On the basis of social rates of return, which fall steadily as we go up the educational pyramid, we are told that primary and middle education should be developed at the expense of secondary and higher education, except for engineering studies, and that suitable measures should be taken to increase the "price" of education at these levels (2) and/or to correct the salary scales; this is technically possible in India, since two-thirds of the qualified manpower in that country is employed in the public sector.

62. But can we be really sure that reducing the private rate of return in certain sectors of education will be sufficient to discourage young people from acquiring that education? In India's case, the answer is clear, since underemployment of qualified personnel is no novelty and, already in the past, "educated unemployment has worked to reduce the earnings of the educated exactly as predicted by economic theory, but the decline has never been fast enough to reduce the incentives to acquire still more education". In other words, what is being proposed is to prolong or accelerate an evolution already under way but which, we are told, has been prevented from reaching its goal by imperfections in the labour market and certain particular features of the underemployment of qualified personnel in India.

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(1) The causes of graduate unemployment in India, by M. Blaug, P.R.G. Layard and M. Woodhall, (forthcoming)

(2) By instituting school fees. In the mind of the authors, these fees, imposed on the wealthiest students, could be used to finance a scholarship system for the most needy. This would 'kill two birds with one stone', reducing the demand for education and, at the same time, bringing it within the reach of the underprivileged classes.

63. But India's case is an extreme: underemployment in the public sector is visible to the naked eye. The situation is likely to be less simple in industrialised countries, where at least two rates of return co-exist for the same type of education - that calculated on the basis of earnings in the public sector, and that for the private sector. It is not easy to decide which of the two should be used as a criterion; admittedly the wage structure in the public sector could be improved by systematic use of job analysis techniques, but since these are "service" activities, wage-level determination cannot wholly follow the law of the market.

64. Another reason, common to all countries, for rates of return having only a remote relation to the real state of the labour market lies in the wage structure used by individuals to calculate the updated total of their lifelong earnings. As in the case of economists for lack of statistical data, it is the present scale of income stratified by age and educational level that guides them in their calculations. In so doing, they assess correctly their starting income by considering that of the active individuals around them; but their calculations of future income are wrong to the extent that they do not know the future state of the labour market. To correct this error, each person's estimate would have to allow for all the similar estimates made by others at the same time; thus, if a young engineer decides to embark on an engineering course, his future income level is likely to vary according to whether 100 or 10,000 persons are taking the same decision at the same moment (1).

65. More generally, adopting the present scale of income stratified by age as an approximation of future income structure implies that the levels of supply of, and demand for, a given type of skill will be the same in the future as at present.

66. In practice, this approximation is likely to have some important consequences. Let us assume that there is a skill for which demand is high and supply low; the rate of return on studies leading to this skill is likely to be high, and students will flock into this branch of study; they will flock into it all the more the higher the anticipated income, based on the current low supply. If demand does not increase, a situation will soon be reached where the supply will be too high

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(1) Only one study has so far attempted to make a systematic comparison between present structure by age and educational level and the corresponding real structure by means of a cohort followed in time. This is Cross-sections and Cohorts in Education and Income, by R. Hollister, Paper No.11 (Annex) prepared for the Educational Growth Review. One of the conclusions of this study is that there are significant differences between the wage structure of a cohort and that which can be forecast on the basis of the structure at a given moment. The direction and extent of these differences vary with the educational level and the age group concerned.

and the rate of return will fall, thus discouraging young people from taking up this line of study. There again, they are likely to be discouraged in too great a number and for too long, since they are basing their expectations of income on the current level of supply, which is high.

67. To sum up, using rates of return calculated on the basis of current income structure is likely to produce a succession of "over-supply" and "under-supply" situations for a given demand, interspaced with variable reaction times. It is difficult to see how equilibrium could be reached.

68. There remains the question of the incentive value of rates of return; supposing that they reflect prevailing conditions on the labour market, are they powerful enough to govern individual behaviour? Recent experience in industrialised countries is not wholly conclusive in this connection. On the one hand, there is a growing demand for university places, which may be due, partly at least, to hopes of higher income; on the other hand, this demand is not always directed at disciplines thought to be the most remunerative; on the contrary, the disciplines enjoying public favour are those without any very precise occupational future.

69. In the same way as we observed that educational level (and age) is not the only factor determining income, we are forced to conclude that anticipated income is not the only criterion affecting the choice of a study course.

D) Rates of return and long-term economic growth

70. All the protagonists of cost-benefit analysis applied to education are aware that rates of return are a very short-term tool in the overall economic context. Even so, it should be remembered that calculating a rate of return may be fruitful, even in cases where there is no certainty that salaries prevailing on the labour market bear any relation to the productivity of qualified manpower. These rates provide an assessment of how rational the past and present demand for education is compared with the existing wage structure.

71. But if rates of return are to guide future investment in education, it becomes vital that the wage level for each qualification should truly reflect the contribution of each type of personnel to the output. Whenever there is reason to suppose that "market prices" fail to reflect the productivity of certain types of qualified personnel (like the 'service' employees already referred to), the advocates of the rate of return approach suggest the use of "shadow" wage levels. But using a "shadow" wage is an admission that the demand expressed for this type of personnel is not the "true" demand, that it is lower or higher than the real "requirements". Determining shadow wage levels, therefore, involves estimating these requirements.

72. Lastly, the use of rates of return to determine a more rational future distribution of the available financial resources presupposes a very high degree of substitution between personnel with different qualification levels and a perfectly elastic demand for each type of qualification. In other words, the accent here is placed on the polyvalence of the qualification, so that its holder would gain access to a very large number of jobs. It is easy to see how there can be substitution, within certain broad categories of disciplines, between personnel of different qualification levels; it is less easy to see specialists substituting for each other smoothly in accordance with the progress of economic growth.

73. The whole problem, therefore, is to know how the qualifications market is going to evolve in industrialised countries. Are we moving towards more occupational mobility in general, as is sometimes maintained, towards over-early specialisation, or towards assisted mobility within ever narrowing limits set by the original qualification?

3. THE "MANPOWER" APPROACH

74. As stressed in the introductory section, the idea at the basis of this approach is that of complementarity between the economic and the educational systems, the needs for qualified personnel of the economy being considered as one of the objectives of education. This approach is of a technological nature, in other words, a given output requires certain production techniques which, in their turn, require certain qualifications of the manpower employed. The nature of this relationship is precisely what enables this approach to sidestep the dilemma underlying the previous ones: should education be considered as a consumer good or as a capital good?

75. This problem is disregarded by the technological relationships of the manpower approach. The central idea is that there is a relationship, as rigid as possible, between the production apparatus and the training apparatus. This is why the many studies on this approach are concerned neither with social inequality in respect of education, nor the monetary or other benefits that education may secure.

76. Hence the two kinds of criticism levelled at this method. The first, the more "philosophical", concerns the role of education: is one of its purposes to prepare youth for occupational life? In other words, should educational policy decisions take the future development of the labour market into account? There are probably very few people who would answer this question with an unqualified 'no'. The second kind of criticism concerns the technical feasibility of making sufficiently accurate and reliable forecasts to guide the development of the educational system. All we can say at this stage is that forecasts of qualified manpower are

based inevitably on a certain number of hypotheses simplifying reality. After a brief description of the method, we shall discuss these hypotheses and the efforts made by planners to overcome the problems they raise.

A) Manpower forecasts for quantifying the economic objectives of education

77. As already stated, the main interest of this approach is that it is directly linked with long-term economic objectives; not surprisingly, therefore, its first stages belong to pure economic planning. Let us review them rapidly (1).

(i) The most common way of defining long-term economic growth is by way of the gross national product. Sector growth rates are also considered essential to give an idea, rough though it may be, of the structure of G.N.P. In practice, the current vogue for planning has resulted in formulating such objectives in practically every country. But in most cases, these are short or medium-term objectives - five years at most - whereas an educational planner needs 10 or 15 year objectives, because of the long period of gestation required for the training of highly-qualified personnel.

(ii) The second stage consists in determining future sector productivity trends. This produces a productivity growth rate for the whole of the economy. This growth rate should be compatible with that obtained by comparing the development of G.N.P. with that of the supply of labour resulting from demographic projections and the evolution of activity rates by age and sex.

(iii) In the third stage, the long-term G.N.P. objectives and labour productivity are compared in order to calculate employment, total and by sectors, for the final year. This is the end of the path common to pure economic planning and educational planning. Comments and/or criticisms up to this point apply therefore to both.

(iv) Then, the current occupational structure for each sector is projected as far as the end year by: extrapolation of past trends, or international or inter-firm comparisons, taken separately or combined. Sometimes rather more refined econometric methods are used; these generally consist in relating sector

(1) The basic work on this subject is H.S. Parnes, Forecasting Educational Needs for Economic and Social Development, OECD, Paris, 1962.

occupational structure to an economic variable (most frequently, labour productivity) whose growth is known. By aggregation, the occupational structure for the entire economy in the end year is obtained.

(v) The next step is to convert the occupational categories into educational levels. The ideal method would obviously be the precedure known as job analysis, which consists in studying the nature of the work done by the members of a profession with a view to ascertaining the optimum educational level needed in the present state of technology. As we shall see, the procedures used at the moment are very much less sophisticated.

(vi) Once the educational stock by occupations for the end year is known, all that remains to be done is to deduct the "survivors" of the current population in the end year in order to obtain the new entrants per occupational category and educational level over the period concerned. The new entrant figures per education level are then multiplied by the reciprocal of the participation rate at each level in order to allow for those who will reach a given educational level but will not make use of it in their active life. Needless to say, these are largely women. The fact that the non-active are taken into account shows that this approach is not necessarily insensitive to the consumption aspect of the education service.

(vii) The final stage consists in translating the requirements over the period into annual graduate flows to be produced by the educational system. Although this already constitutes the answer to the forecasting process itself, this stage is nevertheless mentioned here, firstly, because of its importance - there are several ways in which the educational system can meet a single set of requirements - but also because it reacts on manpower forecasts owing to the qualified personnel - the teachers - which the system needs for its own development.

78. The method described above was used systematically by five(1) of the six countries involved in the first phase of the O.E.C.D. Mediterranean Regional Project (2). Other countries have used it in part or by introducing variants, sometimes of

(1) The exception was Portugal.

(2) See the OECD Country Reports for Spain, Greece, Italy, Portugal, Turkey and Yugoslavia in the Education and development series and the general account of the Mediterranean Regional Project, An experiment in planning by six countries, OECD, Paris, 1965.

major importance; the Fifth French Plan, for example, goes through all the stages listed, except the last; in addition, the long-term economic objectives on which the projections are based are far from explicit (1). In the United Kingdom, the procedure followed by the authors of the Cambridge Growth Project ends with the projection by occupational skills, thus excluding the conversion of these into educational levels corresponding to the different outputs from the educational system (2). Other studies confine themselves to certain manpower categories, highly qualified personnel, for example, whilst maintaining the reference economic framework (stages a,b,c), as in the case of the Baden-Württemberg Land in Germany (3), or eliminating it, as in the United States; in this latter case, scientific and technical personnel "planning" is confined to measures of coordination between the various agencies involved in these problems, the emphasis being placed more on the distribution of these skills than on their increase in absolute value (4).

79. It would doubtless be possible to make this list of variants of the basic method even longer. The only variant we propose to take up here is that which consists in relating economic variables directly to the educational structure of the labour force, thus sidestepping the detour via occupational categories (5). The basic methodology is thus considerably abbreviated, and probably impoverished to the extent that occupational structure forms the common dominator of economic and technological growth, on the one hand, and the educational

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(1) See the "Rapport Général de la Commission de la Main-d'oeuvre du Commissariat Général du Plan d'Equipement et de la Productivité" in the Revue Française du Travail, January - March 1966.

(2) See "Output, Manpower and Industrial Skills in the United Kingdom" by A. Brown, C. Leicester and G. Pyatt, p.240 in The residual factor and economic growth, OECD Paris, 1964.

(3) See "A case study of educational planning: Western Germany", by H.P. Widmaier, World Yearbook of Education 1967, Educational Planning, Evans Brothers Ltd., London.

(4) See "Scientific Manpower Planning: U.S.A.", by J.K. Folger, World Yearbook, op.cit. As the author points out, "The distribution of scientists and engineers to the right jobs may become the central question for the Federal Government".

(5) See Econometric Models of Education, by J. Tinbergen and H.C. Bos, OECD, Paris, 1965.

and training system, on the other. In other words, this method allows objectives to be set in terms of educational stocks, but the whole aspect of the distribution of graduates by occupation, which is tending to become increasingly important, is disregarded. Moreover, as we shall see, it is more difficult to give the future stock of graduates its precise significance: will they really represent the economy's "requirements", or a somewhat reshaped extrapolation of social demand?

80. The approach using manpower forecasts in order to quantify the economic objectives of education, whether considered in its complete or abbreviated form, is rarely disputed in toto. Even if the expansion of the educational system is to be subject to social or political objectives, it cannot be denied that it has manpower implications. Making these implications as explicit as possible can do no harm. Actually, two charges are currently levelled at this method; one concerns the hypotheses on which it is based, and the other, the accuracy of the results to which it leads. Needless to say, the latter depend largely on the former. Let us now review these hypotheses.

B) Hypotheses underlying the manpower approach

81. We shall discuss successively problems relating to economic forecasting (stages i, ii and iii), to the projection of occupational structure (stage iv), and to the conversion of occupational categories into educational levels (stage v).

(a) Manpower forecasts and output theory

82. Since these stages of the method are common to economic and educational planning, it can be expected that the latter will record the progress made by the former. Thus gross product forecasts may be the result of a growth rate held to be reasonable by the authorities (1), or they may be deduced from the forecasts of final demand by category of goods with the aid of an input-output table. Whatever the degree of sophistication of the method, the purpose is the same - to determine the economic growth rate of the country. It is probable that the "precision" of the forecasts is less a function of the planning techniques than of the experience of the planners (2).

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(1) Usually, past trends are extrapolated, with or without acceleration, to take account of circumstances held to be favourable.

(2) To go further into this point would be beyond the scope of this paper. For an excellent and practical guide, see "Méthodes de prévisions économiques à long terme", Informations Statistiques November/December 1960, published by l'Office Statistique des Communautés Européennes.

83. But, the educational planner also needs some measure of productivity, usually labour productivity, to forecast employment. It is clear that using such a measure implies a number of preliminary hypotheses concerning:

- changes in output and other production factors, capital, in particular;
- the degree of inter-substitution of production factors in relation to their price;
- the rate of non-neutral technological progress.

84. If all this is worked out, the production function of the country is known, and there would be no problem in calculating the amount of work required for the end year. In practice, things rarely turn out this way, and the planner is reduced to expedients consisting, for example, in comparing changes in labour productivity with those of the overall productivity of the factors (1) or, more simply and more frequently, relating output and labour productivity by a simple econometric relationship (2). In the latter case, it is important to remember that the coefficient for the relative growth rates of these two quantities implies that all the rest (capital, substitution, technological progress) will continue to vary in the same way as they have done during the period on which the adjustment calculation has been based (3).

85. Put briefly, the planner's use of a labour productivity formula does not mean that he is considering an economy with a single production factor (labour), but that the production function has been determined before he came on the scene. Labour productivity changes are thus a result of the changes in the three factors: capital, output and labour, an acceleration in the growth of productivity representing a higher rate of capital substitution for labour and vice versa.

(b) Occupational structure projections

86. As has already been pointed out, the methods used so far for projecting occupational structures are based on the extrapolation of past trends taken from international or inter-firm comparisons. All too often, unfortunately, occupational structure is surveyed in its entirety only at

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(1) See Productivity trends in the United States, by J. Kendrick, NBER, Princeton University Press, 1961.

(2) See "Complementary and long-range projections", by J.P. Verdoorn, Econometrica, October 1956.

(3) See "Fonctions de production et formules de productivité", by A. Vincent, Revue Economique, January, 1969

the time of population censuses. The extrapolations are, therefore, based on a small number of points at some ten-year intervals, the data are sometimes far from comparable, and the planner is often forced to make do with ten or so very broad main categories. International comparisons at a given time help to remedy these disadvantages to some extent (1); using the 1960 censuses, it has been possible to establish comparable data for about forty-five countries, limited of course to the C.I.T.P. main groups. At sub-group level, the data are confined to 25-30 countries and, at the level of the engineering profession, to only about fifteen. However, these figures have been used to produce spatial regression analyses between occupational structure and economic indicators. The adjustments are often excellent at main group level and for the economy as a whole, less satisfactory in the manufacturing industries sector, and very poor in the other economic sectors; their quality also deteriorates the more disaggregated the occupational group.

87. One of the explanations of this phenomenon lies in the basic hypothesis underlying all these analyses. This is that, once the production techniques have been chosen (and this depends on the relative prices of the production factors), there is one, and only one, corresponding occupational structure.

In symbolic form: $Lj/L = \min (X/L)$,

in which Lj = the number of persons in category j, L = total employment, and X = output. This formula will be recognised as a Leontief equation assuming complementarity relationships between the various Lj fo a given productivity level. In other words, the fixed coefficients in this equation exclude any possibility of substitution between occupational categories. This hypothesis has been contested by all critics of this manpower approach (2). The results referred to above lend considerable substance to their view. As long as a highly aggregated occupational structure is being considered at global economy level, the substitution possibilities are poor; but they improve rapidly as the broad categories are disaggregated, and become particularly strong at sector level. In other words, the "demand" due to economic growth is far from being the only determinant of the occupational structure; supply effects also play an important part in determining it. They should, therefore, be taken into account, particularly at sector level,

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(1) See Occupational and Educational Structures of the Labour Force and Levels of Economic Development. Possibilities and Limitations of an International Comparison Approach, OECD, DAS/EID/69.16.

(2) See R. Hollister, Technical Evaluation of the First Stage of the Mediterranean Regional Project, OECD, Paris, 1967, pages 20-24 and 37-43.

where their role is so important; sectoral distribution of the numbers in each occupation is in fact "aberrant" in terms of "demand" variables (1). Supply conditions alone can "explain" the fact that the proportion of clerical workers in the services - though varying considerably from country to country - hardly shows any increase when per capita income increases. The consequence is permanent underemployment for large fractions of the active population.

88. It is mainly at inter-firm comparison level that optimum employment conditions have some likelihood of being realised. But even at this level, there is reason to suspect that the problem is being by-passed. It is not so much industrial firms who are involved (at sector level, the manufacturing industries sector); exposed to domestic or international competition, their occupational structure is likely to be more sensitive to technological "requirements". The firms with "elastic" manpower absorption capacity are in fact all protected firms, whether administrations, or public or private firms. This is why there is no guarantee that wage rate comparisons between protected and non-protected firms really reflect supply effects; in many developing countries, current wages in services by levels of qualification are comparable with industrial wages, working conditions completing the explanation.

89. Lastly, it should be stressed that occupational structure projections are always made in terms of current or end year stocks. In general, therefore, the phenomena of occupational mobility within sectors and intersectoral redistribution of occupations are largely disregarded.

90. The stock of "technicians" in manufacturing industries in the end year is due to the number of "survivors" of this occupation in this sector, minus (a) emigration to other sectors, and (b) 'promotions' in this sector or others, plus (a) new entrants into the sector and occupation coming onto the labour market for the first time, and (b) immigrants into the occupation, whether from the same or other sectors (2). The lack of statistics

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(1) See Occupational and Educational Structures..., op.cit. Comparing certain graphs in this study is particularly enlightening; whereas the occupational structure/productivity correlation is fairly good at global economy level (graphs II-1 to II-5), the same correlation is non-existent at the services level (graphs II-10 to II-13); moreover elasticities are very low.

(2) See B. Grais, Techniques de Prévision de Population Active par Profession et Niveaux de Qualification, OECD, Paris, 1966.

on personnel flows between occupations and/or sectors has so far prevented most planners from taking account of mobility phenomena, whose consequences for education and training are certainly far from negligible (1). Another virtue of analysis in terms of flow would be to help throw light on the true causes of manpower changes in occupational categories (i.e., not only the requirements of the economy and related wage rates, but also occupational age structure, regional employment equilibrium, institutional factors impeding or favouring the development of certain occupations, etc.), whereas up to now planners have confined themselves to noting the apparent link between occupational structure and productivity (2).

(c) Conversion of occupational categories into educational levels

91. It has become a truism to say that the occupation/education relationship is the most difficult stage in the manpower approach. The difficulties are due to various factors:

(i) the heterogeneity of the occupational categories concerned makes it impossible to relate each category to an educational level. The planner has to consider an "educational profile" for each category which takes the form of a vector;

(ii) this educational profile covers a certain number of educational levels or types, sometimes complementing and sometimes replacing each other. The latter occurs when there are several forms of education for the performance of a particular occupation. The role of the "supply" structure of qualified personnel, i.e., that of the educational system itself, is therefore likely to have a significant part to play in determining the educational profile;

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(1) See Education, human resources and development in Argentina, methodological problems and statistical data, OECD, Paris, 1968. In Annex P, "Vocational training and occupational mobility", there is an attempt at practical application in which the incidence of mobility on training has been estimated. For a valuable attempt to fill the statistical gap in this area, see the INSEE enquiry into the mobility of the French; the main results were published in Etudes et Conjonctures: "La mobilité professionnelle en France entre 1959 et 1964", October 1966; and "Une enquête sur la formation et la qualification des Français (1964)", February 1967.

(2) In this connection, the work of Professor Stone on demographic accounting constitutes an essential preliminary to any causal analysis; see Demographic accounting and model building, DAS/EID/69.5 mimeographed, OCDE.

(iii) lastly, every time this educational profile vector is upgraded, the cause is difficult to determine. Is it a consequence of "demand" linked with technological development (clerical workers would need a higher level of education, because their work becomes more and more complex)? Or is it a result of the growth in the "supply" of qualified personnel from the educational system (clerical workers' general level of education would go up because of the generalisation of enrolment to broader and broader social strata)?

92. Theoretically, at least, it would perhaps be possible to solve all these problems by "job analysis" techniques. These ought to tell us the optimum amount of education broken down into the types necessary for the performance of the functions of an industrial draughtsman, for example; any differences noted in comparison with the actual level and type of education of this kind of personnel represent a degree of "under-education" when positive, and indicate an "upgrading" of the occupation due to a continuously broadening consumption of the education service when negative.

93. There are very few countries where studies of this kind have been carried out. Only the United States and Sweden have followed this line of enquiry, the former on a large scale (1) and the latter for certain specific occupations. The major drawback of these studies, apart from their cost, is the length of time they require, and they are, therefore, likely to become out of date in view of the rapid rate of technical advance and the changes this involves for educational inputs.

94. In practice, planners have adopted a certain number of simplifying hypotheses, each of which is a watering down of reality. Firstly, the educational profile vector is generally simplified in the extreme; only "formal" educational levels are taken into account; occupational and on-the-job training are generally disregarded, the former, because of the heterogeneit of existing types of training and the lack of statistical data, th latter, because of the practical impossibility of measuring the amount of experience necessary for acquiring certain skills (2).

95. As regards projecting educational profiles for occupational categories, the lack of chronological data has forced planners to use the

(1) U.S. Department of Labor, Bureau of Employment Security, Estimates of Worker Trait Requirements for 4,000 jobs.

(2) This probably varies with individual aptitudes, but the time spent at the same work station would probably give a good approximation.

expedient consisting in making the country's current occupation/education matrix dynamic by introducing a third dimension - either age or economic sector. Each occupation's educational profile for the youngest age groups, generally the best educated, gives an idea of the future development of the educational profile for the occupation as a whole; similarly, the educational profile of the most dynamic sectors is taken as a target for the less advanced sectors. These evaluations are fairly sound, since they relate only to the educational profile of "new entrants" by occupational category over the projection period, and not to total stocks in the end year. These are obtained by adding the new entrants to the related "survivors" in the end year (1).

96. Whatever the method used, it is clear that the difficulties referred to at the beginning of this section are not solved, only by-passed. Substitution possibilities between educational levels are taken to be zero, once an occupation's total strength has been determined. As before, we have

$$Lk/L = \min (Lj/L)$$

or finally,

$$Lk/L = \min (X/L),$$

in which Lk represents the number of persons having a level of education k.

97. Making substitution possibilities between levels of education zero is tantamount to saying that the "supply" of qualified personnel by the educational system has no effect on the educational profile of the occupational categories, or, again, that the variations in the latter are due exclusively to the requirements of the economy.

98. Statistics on the educational structures of occupational categories, economic sectors and labour forces are available at this moment in a certain number of countries (2). Systematic study of these has revealed that the simplifications we have been discussing are largely inaccurate (3). We know now that:

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(1) For a detailed application of this method, see Education, human resources and development in Argentina, OECD Paris, 1967, in particular chapters 22 and 23.

(2) Statistics of the Occupational and Educational Structure of the Labour Force in 53 countries, OECD, Paris, 1969

(3) Occupational and Educational Structures of the Labour Force and Levels of Economic Development, DAS/EID/69.16, OECD, op.cit.

(i) the educational level of most occupational categories depends not only on 'demand' indicators - of the labour productivity type - or on occupational structure (Lj/L);

(ii) substitutions are therefore possible, but less perhaps between persons of differing educational level than between persons having a minimum of education and those having none. A possible reason for this is that only formal levels of education have been taken into account, one of the main substitution possibilities being that occurring between academic secondary education and occupational training. Actually, it would appear that these two forms of education are more complementary (going through the former opens the doors of the second) than substitutable (1). Studies taking only formal educational levels into account do not, therefore, produce 'wrong', but merely incomplete, conclusions;

(iii) these substitutions are, to a large extent, caused by the "supply" effects due to the past and present development of the educational system. The low substitution rates between formal educational levels referred to under (ii) only reveal a supply structure whose constituents are not independent; the secondary level has to be negotiated before being admitted to the higher level. This does not mean that all pyramids representing educational systems are alike, only that imbalances between levels of education persist for a long time before manifesting themselves at the level of the educational structure of the active population.

C) Requirements and demand for qualified manpower

99. As has already been mentioned, the manpower approach is based on a set of Léontief-type technical coefficients which disregard any price and cost considerations. To determine the "requirements" for qualified personnel by means of these coefficients is one thing; to express a 'demand' for this same personnel via the labour market is quite another. The only way to translate these requirements into demand is obviously to bring in the price of this qualified manpower, in other words, the wage structure by educational level.

(1) On the various ways of acquiring skills, see: "Skill acquisition and development", by J. Blum, in Lectures and Methodological Essays on Educational Planning, OECD Document, 1966.

100. All forecasts of manpower requirements made so far have suffered from this omission and its twofold consequences. Firstly, the effectiveness of the forecasts is severly curtailed, since there are no incentives for the workers to distribute themselves over the various occupational categories and educational levels in the way suggested by the forecasts. In fact, the situation most frequently met with is that the existing wage structure conflicts with the changes which the planners wish to be made; the farming sector is undermanned in qualified personnel and its 'requirements' are, therefore, considerable; but wages need to be high to compensate for the working conditions, which are less pleasant than in towns.

101. The second consequence concerns the projection technique itself. To the extent that the occupational and educational structure projections are based, in one way or another, on current structures, and to the extent that the latter do not reflect "requirements" but are the result of the supply and demand for each type of personnel on the labour market, there is a danger that what will be projected is not requirements but the current surpluses and shortages of each skill. It is clear that knowledge of the development of wage rates for a given skill would help to determine whether the number of active persons with this skill is, in fact, the optimum corresponding to the requirements, or greater or less, but only on condition that the wage rates in force change in sympathy with the surpluses or shortages concerned and reflect the marginal productivity of each skill. As the above example shows, these two conditions are far from being met in every case. Wage structure must, therefore, be used here with all necessary precaution.

4. THE USE OF MODELS IN EDUCATIONAL PLANNING

102. Compared with the three preceding approaches, the use of models in educational planning is a relatively new development. On the other hand, the past five years have seen a spectacular growth in models devoted wholly or in part to educational planning problems, and their description would be beyond the scope of this paper. There are several ways of classifying the existing models:

(i) by field covered, ranging from the simple teacher/pupil relationship, which itself is a model, to ambitious constructions optimising the whole of the economy, social justice, and educational system;

(ii) by the framework they relate to: general models applying to national or regional levels, or, conversely, micro-models at university department level;

(iii) by the use made of them; they can be descriptive of past and present reality; the parameters worked out from past data can then be kept constant for the future, so that the model will provide an extrapolation of the present situation; they can also be of a more explanatory nature, in which case the parameter values are determined by exogenous variables whose development is known; they are described as "forecasting" models when their solution allows for a number of alternatives in relation to the values given to the parameters in a simulation process; lastly, they can acquire value of decision: this is the case, in particular when an optimising process in relation to certain criteria or constraints is involved in their solution;

(iv) it follows from the foregoing that the mathematical methods implied by the use of a model enable it to be situated fairly precisely; a simulation model is more than a simple description of reality, whereas a system of simultaneous equations excludes any recourse to the optimum notion.

103. The characteristics set out above are not as independent as they appear for the purpose of this brief review. When we refer to an educational planning model, details on all the four points referred to - scope of the model, framework, mathematical methods and the use to which it is to be put - are at once necessary and sufficient to give the model its correct place in the overall educational planning context.

104. Bearing in mind the subject of this paper, we shall confine our discussion to a few models only (1).

- These will be of sufficient scope to take in the whole of an educational system and all or part of the economic and social system in which it is placed. Thus, we shall exclude models of the "consequential" type, designed to estimate the implications of an advance growth of the

(1) For an excellent survey of the main work done on educational planning models, see by K.A. Fox and J.K. Sengupta, "The specification of econometric models for planning educational systems: an appraisal of alternative approaches", Kyklos vol.XXI, Fasc. 4, 1968.

educational system in terms of teachers and premises (1);

- We shall only deal with macro-models, thus disregarding studies on university planning (2). The latter tend more and more to be internal management models, and thus to exclude the problem of impact on the rest of the system or on society;

- It is not possible to discuss the value of a mathematical tool in the abstract. Here, our point of view will be that of the planner questioning whether the improvement in mathematical methods has not outpaced the growth in our statistical knowledge of educational facts. In fact, all the models studied highlight the weakness of the latter in comparison with the former, whose value has thus become largely relative; for example, the debate about the linearity theory currently accepted for most relationships between variables in a very large number of models remains largely academic in the absence of even rudimentary statistical evidence.

105. As already pointed out, mathematical models cannot claim to form a specific educational planning approach. In fact, one of their properties is to formalise mathematically the theories encountered at the "literary" description level of the other three approaches. Since models are to be situated in the overall context of educational planning, we have chosen to concentrate on three or four models which are more or less representative of the different approaches already discussed:

(i) the social demand approach, or that of the autonomous growth of the educational system, is illustrated by all models using the three traditional ratios (transition, repeatings and drop-outs) to describe the internal dynamics of the educational system: here, we shall concentrate on the model describing

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(1) See, for example, Hector Correa's sub-models on teachers and premises, and the cost and financing of educational plans in his "Survey of mathematical models in educational planning", in Mathematical Models in Educational Planning, OECD, Paris, 1969.
For a recent and improved example, refer to the SOM model (simulation option model), a description of which is given in "The role of analysis in educational planning" by B. Schwartz, STP(70)13, prepared for the Educational Growth Review.

(2) See the C.A.M.P.U.S. model, described in "Simulation and rational resource allocation in universities", by R.W. Judy, Efficiency in resource utilisation in education, OECD, Paris, 1969. Other studies of a similar nature were presented during the Conference on University Planning and Management Models, held in Paris from 21st to 24th April, 1969; refer, among others, to "Institutional Management and Planning Techniques at the University of Sussex," by G. Lockwood, OECD, DAS/EID/69.28

the Norwegian educational system (1);

(ii) the rate of return on education as the guiding principle predominates in the model developed by S. Bowles and applied to Nigeria (2);

(iii) lastly, the more ambitious models constructed for Argentina and France aim at optimum allocation of resources as between the educational system and the economic system (3).

106. Our only aims in these pages is (a) to see to what extent these models provide an answer to the problems and/or limitations inherent in each of the three approaches, (b) to determine if these approaches can be improved by using mathematical language and (c) to find out whether models represent a first step towards a synthesis of these three approaches.

A) Social demand approach and mathematical model of the educational system

107. The Thonstad model describing the Norwegian educational system is based on the Markov fixed transition coefficient chains procedure (4); the coefficients are those noted for the base years, in this case, between 1961 and 1963. It follows that the only result this type of model can produce consists of extrapolations into the future of the current trends of the educational system. This is no insignificant result; given the sometimes very great inertia of educational systems, an autonomous projection has pedagogic value (what will happen if present coefficient values are maintained?); the projection can form the first of the alternatives for the future.

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(1) "A mathematical model of the Norwegian educational system", by T. Thonstad, Mathematical Models in Educational Planning, OECD, Paris 1969.

(2) "The efficient allocation of resources in education", by S. Bowles, Quarterly Journal of Economics, May, 1967.

(3) "A linear programming model of educational planning: a case-study of Argentina", by I. Adelman, in The theory and design of economic development, edited by Adelman and Thorbecke. "Un modèle d'affectation optimale des ressources entre l'économie et le système éducatif", by Jean Benard, Bulletin du CEPREL No. 6 July 1966. A summarised version of Benard's model has been published in English under the title "General optimization model for the economy and education" in Mathematical models ... OECD, op.cit.

(4) The term "transition coefficients" is used here in its wide sense, meaning transition into active life (drop-out), into the same class (repeating) and to the next higher class (promotion).

108. If we had to name a non-mathematical equivalent of these models, we would say that they correspond, by and large, to what we have termed the "contingent" social demand for education, but the model has the advantage of extrapolating not only inputs into the system (new entrants) and outputs (graduates), but also the numbers in each year of studies; hence more detailed conclusions can be drawn regarding teachers, premises, and school career bottlenecks than with just the total numbers.

109. Obviously the only way of improving these models is by introducing variable transition coefficients, in which case the methods used and the difficulties encountered will be the same as those described in the social demand approach: (i) the starting point could be the geographical situation at a given moment, by disaggregating the national transition coefficients into regional coefficients; then the explanatory factors for these regional coefficients would be investigated for each region and translated in the form of practical explanatory variables; lastly, spatial regression analysis would be used to estimate the relative influence of these factors, making every effort to overcome the well-known interaction problems; (ii) an even better method would be to work out these transition coefficients for sub-samples at the national level. The various coefficient matrices obtained in this way for children of different characteristics (social and geographic origin, sex, place of residence, etc.) would then enable the relative importance of these characteristics to be estimated, and forecasts to be made on the basis of variable transition coefficients.

110. Overall, the conclusion must be that mathematical models based on the dynamics of the educational system are far from having exhausted all the possibilities of the social demand approach. On the contrary, its "literary" discussion is far ahead of mathematical representation, which has been slow to appear and does not seem capable of offering any new solutions.

B) Rates of return and resource distribution model for education

111. The objective function of the Bowles model enables it to be related unequivocally to the educational rate of return approach. The latter is defined in the following terms: "The objective function is the contribution of the educational system to future national income, measured by the increment in discounted lifetime earnings attributable to additional years of education". In this case, the model's limits are those of the rate of return: how is the fraction attributable exclusively to education to be calculated? What of education's non-economic benefits? Do current market wages accurately reflect workers' marginal productivity by levels of skill? Are substitutions between levels and types of skill sufficient to meet the long-term economic demand?

112. Nevertheless, on the cost side, the model represents a certain number of advantages compared with rate of return claculations. Instead of having to make do with an overall pointer towards more or less investment in a given direction, it provides a means of evaluating the consequences of innovation in educational structure or technology, of various options in the course of a given cycle of study, of changes in the number of entrants into a cycle, etc. The necessary input/output coefficients - in this case, largely pupil/teacher and other inputs/pupil ratios - vary, it would seem, on the basis of the available time series.

113. In other words, the Bowles model represents the combination of two sub-models: one comprises the social rates of return proper, the other treats the educational system as a production function with inputs (new entrants) related to outputs (graduates) by transition coefficients similar to those described in the preceding paragraph. The link between the two sub-models is formed by coefficients representing the inputs by cost, and graduates' earnings representing the output by benefits.

114. It is clear, therefore, that this model represents an effort to extend somewhat the traditional cost-benefit analyses by means of a more detailed analysis of the structure of costs and their possible variations; the latter can represent a reduction (shorter careers, importing of foreign-paid teachers) or an increase, if there is a systematic policy aimed at improving the quality of the teaching body, as is the case in primary education in Nigeria.

115. It is clear, however, that the model cannot form a synthesis of the different approaches as long as the objective fonction remains what it is. To proceed in that direction, it would be necessary to introduce additional constraints into the model, representing, for example, insistence on a minimum enrolment level for a given age group as regards the social demand approach, or the need to produce certain specific skills in the case of the manpower approach.

C) Manpower forecasts - model optimising economy and education

116. The models of Adelman and Benard are both attempts to reconcile the investment in education and the 'manpower' approaches. As Adelman clearly states: "Philosophically, the model formulated is a cross between the manpower requirements approach to educational planning and the benefit-cost approach. As in the manpower requirements approach, the model described generates its demands upon the educational system from the production side of the economy and uses fixed labour-output coefficients for each class of manpower and for each sector of the economy ... There are also some similarities with the cost-benefit approach; the extent of resources to be devoted

to education is determined in the present model by comparing the marginal social benefit of each type of education with its marginal social cost."

117. Very briefly, Adelman's model consists in optimising investment in education simultaneously with investment in physical capital in the other economic sectors, allowing for a certain number of linear constraints representing the limits imposed by the technological and socio-cultural environment. By and large, this model can be said to "borrow" the qualified manpower demand aspect from the manpower approach with, however, some important modifications: although, as in the classic manpower approach, no substitution between occupational categories is allowed for, constant substitution rates between educational levels in the same occupational category are introduced by means of the relative wage rates of these different types of personnel. This latter point certainly represents an improvement on the classic approach, even though the soundness of the hypothesis of constant substitution rates is debatable, especially in the longer term.

118. From the educational rate of return approach, the Adelman model borrows its way of evaluating the increases in the stock of human capital by means of the differences in wages attributable to education and updated throughout the projection period. Here, again, all the limitations inherent in cost-benefit analysis as applied to education make their reappearance. One of these, namely, that the average earnings by each type of qualified manpower accurately reflect their differential productivity, is even the subject of a special discussion, making use of "shadow" prices for the various graduates. Unfortunately, the author's account of this very interesting question is so succinct that the reader is left to speculate about the real scope of the model.

119. Benard's model also takes "the form of a sequential linear programme extending to the whole of a country's economy and treating education as one of this economy's sectors or activities. Its purpose is to determine optimum allocation of mainly physical resources between educational activity and commercial economic activities. This optimisation is arrived at by maximising a social preference function subject to constraints." In this model the activity of the education sector is defined by means of a production function connecting inputs (pupil flows, teachers' work, depreciation of premises, etc.) to the output (graduates), subject to two additional constraints related to minimum growth of the educational system and maximum budget for educational expenditure. Graduates have to satisfy the requirements of the other sectors of activity; as regards their "prices" - in this case, current market earnings - these are introduced into the model explicitly (dual system). "At the optimum, the value of the preference function in the dual system is minimised. In our model, the value represents the minimum cost to the nation of the expenditure

required for the operation of the system and corresponding to the distribution of productive forces and factors over the sectors derived from the optimisation of the basic programme."

120. Thus Benard's model, too, is an attempt at synthesizing the different educational planning approaches, if we accept that certain constraints of "minimal" development affecting the educational system can be considered as an attempt to include the social demand aspect. It should be added that, for once, the description of the model is accompanied by all the necessary detailed information on parameter calculation, together with a description of a trial model (1) whose first results have been analysed (2).

121. Planners will undoubtedly have their reservations as regards the statistical data used - a certain measure of schematisation being inevitable - but will nevertheless adopt the conceptual framework of this study, in the hope that it will be possible to build on this framework.

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(1) "Optimation, économie, éducation; présentation d'un modèle d'essai et calculs des paramètres", by F. Ettori, C. Girardeau, M. Manuel, D. Rouard and G. Terny, Bulletin du CEPTREL, No. 6. July 1966.

(2) "Modèle d'affectation optimale des ressources entre l'économie et l'éducation. Mise au point et premiers résultats du modèle d'essai", by M. Manuel, D. Rouard, F. Ettori, Bulletin du CEPREL, No. 9. June 1967.

CHAPTER II

EDUCATIONAL PLANNING METHODS - A SYNTHESIS

122. Attempting a synthesis of the main educational planning approaches described above is certainly no easy matter, all the more so as the role allotted to education differs according to the approach selected. And yet no pronouncement is ever made on modern educational problems that is not based, implicitly or otherwise, on such a synthesis.

123. Here we shall consider only three approaches: those based on social demand, on the rate of return and on qualified manpower requirements. It is, in fact, their underlying hypotheses that have to be reconciled in the first place. Mathematical formulation using a general model can only follow after agreement has been reached on the respective importance to be given to these hypotheses and on the way they are to be interrelated.

124. Two of these approaches relate educational problems to technological (manpower forecasts) or economico-financial (rate of return) imperatives. The third disregards these materialistic criteria and obeys socio-political criteria (social demand). On the face of it, we have here two totally different worlds whose views are not likely to be reconciled in the near future. If we persist in attempting such a reconciliation, it is because all these methods, taken individually, seem perfectly valid as long as they are used to describe past or present reality (1). However, each seems partial and strangely ineffective when it comes to altering the future course of events. Never has the overall point of view been so necessary as at the present stage of educational planning.

125. Let us repeat that the purpose here is not to develop a new syncretism between what can be subjected to rational economic criteria and what is and must remain normative; it is more modest. We shall start by inquiring whether the varying degree to which forecasts are realised with the various methods can be used as a criterion governing their choice. Next, we shall show that the failure of the forecasts has its origin in the way in which the relationships between forecasts, educational policy and decision-making have been envisaged until now. Lastly, we shall attempt a synthesis of the different approaches.

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(1) Admittedly, each one gives a view that is only partial, but still constitutes a fraction of the total "truth".

1. The validity of forecasts as a criterion

126. If a synthesis of the different approaches is difficult, choosing the "best" of the three approaches could prove more fruitful. It should be possible to work out a hierarchy of "good" and "bad" planning methods, the former being those whose forecasts have proved more valid than those of the latter. This idea is likely to become increasingly popular as more and more educational plans appear on the scene; some of them have already been in existence long enough to be compared with reality.

127. But is it possible to state that the difference between forecast and reality is a rational criterion for choosing a method? In our view, this argument is fallacious for a number of reasons:

(i) Firstly, it seems difficult to separate forecasting methods from the means used to achieve the objectives. If there is a gap between forecast and reality, it is not always easy to decide which is responsible, the method or the means.

Thus, if the forecasts of qualified manpower requirements lead to a given development model for the educational system, e.g., a reduction in the transition rate from secondary to university level to meet the economy's need for mid-level personnel, and if the reality turns out to be very different from the forecast made, e.g., 90% of secondary certificate-holders continue to enter university the following year, does this mean that the manpower forecasts approach was wrong, or that the planners and the authorities have under-estimated the forces operating in favour of the status quo?

(ii) The problem becomes more complicated when forecasts are a mix of what is "desirable" and what is "possible" which they mostly are, particularly with the social demand approach. This sets reasonable enrolment objectives for a given social group; when these are not attained, it is clear that it is the means applied to achieve them that were inadequate, since, by definition, the "desirable" cannot be "false".

(iii) Conversely, it is not at all certain that we are necessarily in possession of a "good" forecasting method when forecasts are realised. Forecasts and reality will be the more likely to coincide the more the former are based on the maintenance of the status quo, since there are no new obstacles to prevent this. On the other hand, the more voluntarist the attitude of the planner the more independent of the present situation will his

forecasts be and the larger the number of obstacles of an economic, institutional and political nature to be overcome for the forecasts to follow the plan.

(iv) Lastly, the forecasts made according to the different methods, whether confirmed or not by reality, conflict with each other. It is easy to imagine in a given situation three different forecasts for the development of the educational system. One has only to stipulate the complete enrolment of a certain social group, the other to limit its objective to the training of qualified manpower of a half-stagnant economy, and the third to promote the oil-drilling industry after finding that its rate of return is higher than that of education, and it is clear that there is no common language between them. The hypotheses underlying each of these approaches have been set out in sufficient detail in the preceding chapter to make it clear that the possibility of a decision in favour of one or the other on a strictly technical basis is largely illusory.

128. Pushed to the extreme, the four preceding arguments might suggest that the planner need not be concerned about what happens to his forecasts once they have been made. This is certainly not what we intended to imply; systematic and repeated differences between forecasts and reality are surely a sign that something is wrong somewhere. But, here, the problem of forecasting method is secondary: comparisons between forecasts and reality can in no case be used as a firm basis for the rejection of a method. The problem is a much larger one of the relationships between educational planning, educational policy and decision-making.

2. Educational planning, educational policy and decision-making

129. If the three educational planning methods described at length in the preceding part have something in common, it would appear to be a systematic tendency to confine themselves to the setting of the objectives - generally quantitative in nature - that should guide the development of the educational system. Simplifying somewhat, the social demand approach invariably calls for higher enrolment of children of manual workers, and the rate of return approach favours heavier investment in a certain level or cycle of the system, while the manpower approach stresses the "requirements" for technicians of the economy. But when it comes to ways and means of realising these objectives, we have to conclude that the contribution made by these planning methods is a minor one, and that they need to be supplemented in at least two directions if the "planning" process is not to be restricted purely to quantifying the objectives.

(i) The first of these directions relates to the gap - often enormous - that separates long-term objectives and the making of the decisions which effectively commit the system to a given direction. In the history of the educational systems of OECD countries more decisions of importance have been taken during the last twenty years without reference to any of the objectives set in advance than with the explicit purpose of achieving longer-term objectives. This has been the case of most of the decisions extending the period of compulsory schooling; the cost and the time needed for the effective implementation of these decisions have usually been discussed post facto, which has led to some surprises.

The same applies to structural reforms of the educational system, particularly at secondary level; the planner-cum-forecaster accepts rather than controls or requests these changes in structure, which might be described as the result of an autonomous decision by the policy-maker.

In a more general way, the relative positions of those who set the objectives, those responsible for translating them into short-term policies, and those who make the final decision are ambiguous and seem to vary with the type of decision taken.

In this context, any modern discussion on the strategies to be followed to achieve a given objective must take into account, among other things, the consequences of these strategies in terms of school-building, teaching staff, siting of educational establishments and so on. Ideally, the slightest modification in any one of these strategies should immediately be translated in terms of requirements, which can then be immediately compared to the system's inherent constraints, such as teacher supply, for example (1). Needless to say, in most OECD countries, this procedure conflicts with the traditional framework within which decisions are made, namely, the budget, whether it be national or regional, annual or covering several years. Any moves towards presenting this budget in terms of specific projects instead of by types of expenditure would also help to create this common language for short and long term which is still lacking.

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(1) On this point, refer to the SOM (simulation option model) in "The role of analysis in educational planning" by B. Schwartz, Paper No. 9, STP(70)13, prepared for the OECD Educational Growth Review.

(ii) The second direction consists of converting these long-term objectives into an effective implementation policy. This fundamental and often neglected step continues to be at the root of many miscalculations in several European countries (1), France and Great Britain, for example, where students are still staying away from the science faculties despite the planners' emphasis on requirements for scientific and technical personnel (2). In order to give students an incentive to fall in line with the objectives, special budgetary measures have been taken in favour of the French science faculties, and science programmes have been eased at secondary education level in order to encourage possible candidates for science studies. In the United Kingdom, the private rates of return on higher education in science are said to be higher than for the other faculties; either the difference in the rate of return is not big enough to encourage the students, or else, they make their decisions without any regard for their future income.

130. Whatever the reasons, these two examples show clearly that an educational policy can be effective - that is, in conformity with the objectives - only if the planners are in command of all the mechanisms controlling the development of the system and fully aware of the main factors governing individual conduct. For this purpose, their work would have to be more explanatory and less descriptive. It is only fair to add that the social demand school has already made considerable progress in this direction, as was shown in Chapter I: the rate of access to a given educational cycle is for a given social group no longer a variable exogenous to the system; it is a function of a certain number of explanatory factors on which the policy-maker may act if he wishes to. The supporters of the manpower approach, too, strive to explore the nature of the link between education and employment, after having been long confined to relatively broad statements. As for rates of return on education, these are only the results which conceal a whole series of factors and it is these factors that need clarification.

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(1) For more details on this question, see "Educational Policies, plans and forecasts during the nineteen-sixties and seventies", by G.L. Williams, Paper No. 5 /STP(70)10/, prepared for the Educational Growth Review.

(2) The Robbins Report envisaged that 37% of all students should register in the "arts faculties" in 1966/67, against 40% in 1962; the actual proportion in 1966/67 was 44%. See The impact of Robbins. by C.A. Moser, P.R.G. Layard and J. King, Penguin Books, London, 1968. For France, the proportion of students registered in science faculties was 34.4% in 1960/61 and 31.9% in 1965/66, compared with the 41% forecast in the IVth plan (1960/61 - 1964/65).

131. Without such an investigation, all educational policies are likely to be limited, as in the case of the science faculties in France, to removing the obstacles one by one until realisations conform to the policy and objectives of the Plan. And there is no cause for over-optimism here, since everywhere planners and those responsible for education show, in their search for mechanisms, a marked inclination to attribute an 'explanatory' character to the factors or variables they are able to control or influence, the other factors being simply ignored. A clear view of which factors can be influenced and which cannot is, therefore, essential if an educational policy is to be successful.

3. Towards a synthesis of the three educational planning methods

132. Although, in theory, the differing viewpoints may be difficult to reconcile, in practice, most countries aim at satisfying a part of social demand as well as the requirements of the economy; as regards the rate of return on education, though official pronouncements may refer to them only on rare occasions, any controversy on whether the State should spend more on education and less on motorways for instance, does, in fact, imply estimates of the relative return on these two types of expenditure.

133. It is, therefore, a question of reconciling the trend towards democratisation, the qualified manpower requirements of the economy, and the claims of financial orthodoxy.

134. One of the clearest lessons from the ten years of educational planning in OECD countries is unquestionably the extraordinary degree of inflexibility and inertia exhibited by educational systems. The least that can be said is that their capacity for resisting the directives of planners has been badly underestimated. The case already quoted of the distribution by faculty of students in France and the United Kingdom is not an isolated example. The attempts to give a relatively greater importance to technical secondary education in other countries, such as Germany, Yugoslavia and Spain, have invariably ended up in the same way: the numbers forecast are always higher than the actual numbers (1).

135. This inertia manifests itself regardless of the planning method used, to the surprise of the sociologist at the slowness with which social inequalities in education are levelled out, of the economist at the failure of technical manpower requirements to be met, and, lastly, of the finance specialist at the persistent failure of budgetary allocations to attain their optimum.

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(1) Cf. Paper No. 5, STP(70)10, "Educational Policies,..." op.cit.

136. A synthesis of the various planning methods must, therefore, allow, first and foremost, for a certain inflexibility of supply of graduates by the educational system.

137. Moreover, since the socio-political constraints of democratisation also operate on the supply side, this inflexibility is likely to increase in view of the level already reached and future strivings towards the removal of disparities.

138. Thus, in the years to come, increasing numbers of graduates will come onto the labour market in OECD countries and, in these conditions, two possibilities arise:

(i) the capacity of the economic system to absorb them will be sufficient to maintain the status quo as regards the graduates' choice of occupation and the interplay of supply and demand with regard to graduates, i.e., the wage structure by level of skill;

(ii) this capacity, given the current norms as regards the graduates' choice of occupation and relative wages, will be insufficient to absorb all the graduates produced by the educational system.

139. A glance at the current situation in the United States may perhaps give an idea of what is most likely to happen. The first comment that can be made on this country's labour market is that the rate of unemployment is in inverse proportion to the level of education; intellectual underemployment, in the strict sense, is, therefore, highly improbable. The second is that graduates' choice of occupation, particularly university graduates', is tending to broaden; instead of being limited to a number of higher professional categories, more and more graduates are to be found in occupations such as clerical workers or salesmen. This phenomenon, moreover, tends to arise well before all the higher echelons are filled exclusively by university graduates (1). And the United States is not the only country to exhibit this development; Japan and, to a lesser extent, Canada and some European countries have already begun to follow in its footsteps (2).

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(1) According to the 1960 census, 53% of "professional" Americans have a university qualification; but this is also true of 5.1% of clerical workers and 7.7% of salesmen. Based on the total stock of active persons, all age groups combined, these percentages are far from negligible.

(2) See Occupational and Educational Structures ... op.cit. DAS/EID/69.16, in particular chapter XI.

140. The question now arises whether the earnings of these graduates tend to fall as a result of this broadening of occupational choice. The answer is not easy to find. Miller found that graduates from American "colleges" (sixteen years schooling) maintained their positions in terms of relative earnings compared with "high-school" graduates (twelve years schooling) between 1939 and 1959, despite a very rapid growth in the supply of college graduates (1). The explanation put forward is that the economic demand for graduates was sufficiently high to enable them to be absorbed via the labour market without altering their relative earnings.

141. At least two objections can be levelled at this conclusion:

(i) The first is that Miller's earnings statistics apply to all graduates at work at the census dates. It would be reasonable to postulate that the graduate-earnings relationship tends to loosen with age, since experience, ability, attitudes towards occupation and many other factors generate considerable differences in income between persons with the same level of education. Thus the analysis would have been more convincing if it had been accompanied by details of the differences in initial earnings of the different graduates (25-30 age groups, for example) (2).

(ii) The second concerns Miller's "sixteen years schooling and over" category. In 1939, this was a relatively uniform category formed almost wholly of persons with a primary university degree (of the B.A. type); in 1959, a far higher proportion of these graduates had a higher degree (of the M.A. or Ph.D. type), requiring more than sixteen years of study. Miller's conclusion can, therefore, be qualified as follows: the apparently constant difference in earnings between university graduates and "high-school" graduates is, in fact, no more than a rough average concealing a fall in difference in earnings between persons with sixteen and twelve years of study respectively, compensated, in the present case, by the higher earnings of persons with

(1) "Annual and lifetime income in relation to Education: 1939-1959", by H.P. Miller, American Economic Review, December, 1960.

(2) The use of average earnings for all graduates and initial earnings for new graduates is likely to lead to different conclusions; on this point, refer to the famous controversy on the relative earnings of American engineers - and the possibility of a "shortage" of engineers in that country - summed up in "The economics of scientific and engineering manpower", by Lee Hansen, Journal of Human Resources, Spring 1967.

more than sixteen years of study.

142. There are time series in industrialised countries showing a trend towards a very gradual narrowing of the differences between top management earnings and average income per employed person; thus, a German lawyer's average earnings represented six times the income per employed person in that country in 1930, but only three times in 1950; the average earnings of a French senior civil servant were ten times the average income per employed person in 1920, but only four times in 1950 (1).

143. In an international comparison covering a dozen countries, Bowles highlights a narrowing of the difference in earnings between persons of two different educational levels as their ratio between the number employed with these educational levels increases in the active population (2).

144. Adequate statistics are still lacking to cross-check what has already been sensed in some European countries by the public at large. In France, for example, a growing percentage of the population has felt that the "licence" (first university degree) may well be on the way to taking over the role of the baccalauréat as the starting point for further studies. Hence the growing interest in doctorate courses, which retain their financial advantage. In the United States, the process came into being long ago and is now accelerating; between June 1966 and 1974, American "colleges" and universities should confer 6.5 million bachelor or equivalent degrees, 1.5 million "master" type degrees and 225,000 doctorates; compared with the nine preceding years, these figures represent increases of 71% for the first category and of over 100% for the two others (3).

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(1) These examples have been taken from T. Scitovsky: "An international comparison of the trend of professional earnings", American Economic Review, March, 1966.

(2) "The aggregation of labour inputs in the study of growth and planning: experiments with a two-level CES function", by S. Bowles, Economic Development Report No. 122, November 1968. Project for quantitative Research in Economic Development, Center for International Affairs, Harvard University, Cambridge, Mass.

(3) See N.H. Rosenthal and J.N. Hedges, "Matching sheepskins with jobs", Monthly Labor Review, November 1968, Bureau of Labour Statistics, Washington, D.C.

145. To sum up, the three functions traditionally attributed to the educational system in industrialised countries are likely to combine in the following way during the next ten years.

(i) Increased schooling will encourage the process of reducing the quantitative inequality in respect of education, though this process will not be automatic and is likely to be very slow in view of the resistance to change inherent in the educational system.

(ii) This will result in a supply of graduates that may exceed the economy's requirements, on the assumption that current norms as regards choice of occupation and earnings are maintained.

(iii) Should this happen, it is probable that there will be an upward adjustment of "requirements", a variable proportion of graduates going into jobs which call for less knowledge and ability than those acquired during their training. This trend in the choice of occupation should be accompanied by a lowering of the economic position of graduates in relation to other categories of employed persons. The adjustment system between the supply of and demand for graduates - i.e. the wage structure by levels of skill - is, therefore, likely to play a strategic role.

(iv) This "threat of democratisation" should lead graduates at a given level to aim at qualitative differentiations either upwards (by taking a second university degree, for example), or laterally, by becoming "rare" specialists. It is, therefore, probable that the levelling out of quantitative inequality is preparing the ground for more subtle but no less real qualitative inequality.

(v) This outline would be incomplete if we failed to mention the individual or collective frustration caused by the possibility of a less brilliant occupational future than that hoped for, or justified by the educational qualification obtained. There could be two ways of remedying this state of affairs; in the short term, occupational mobility in all its forms should be promoted, so that the frustrated graduate has as broad a range as possible of occupational advancement opportunities; in the longer term, measures should be taken to reduce the current gap between the skills required by the labour market and those acquired through the training process.

146. Arranging the labour market to meet the mobility requirement, and altering the qualitative content of education so as to attune it to the technico-scientific culture of the modern world are indeed the two major challenges that the educational policies of the seventies will have to take up.